DOCUMENT RESUME

ED 444 347 EF 005 768

AUTHOR	Hauer, Jody; Bombach, Valerie; Mohr, Caryn; Masse, Ann
TITLE	Preventive Maintenance for Local Government Buildings: A Best Practices Review.
INSTITUTION	Minnesota State Office of the Legislative Auditor, St. Paul. Program Evaluation Div.
REPORT NO	OLA-00-06
PUB DATE	2000-04-00
NOTE	167p.
AVAILABLE FROM	Full text: http://www.auditor.leg.state.mn.us/ped/2000/pe0006.htm.
PUB TYPE	Opinion Papers (120) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	Elementary Secondary Education; Guidelines; *Public Schools; *School Maintenance
IDENTIFIERS	*Building Maintenance; Minnesota; *Preventive Maintenance

ABSTRACT

This report identifies seven strategic practices for effectively managing preventive maintenance of Minnesota school district, city, and county buildings; and profiles local jurisdictions currently using them. The following best practices for preventive maintenance are recommended: (1) inventory building components and assess their conditions; (2) build the capacity for ranking maintenance projects and evaluating their costs; (3) plan strategically for preventive maintenance in the long- and short-term; (4) structure a framework for operating a preventive maintenance program; (5) use tools to optimize the preventive maintenance program; (6) enhance the competence of maintenance workers and managers; and (7) involve appropriate maintenance personnel in decision making and in communicating buildings' needs. The report's three chapters provide background information defining preventive maintenance and its values, recommends best practices for preventive maintenance, and explains differences in local governments' use and management of preventive maintenance. Further, it describes obstacles local governments believe limit their ability to perform preventive maintenance and the state's role in local building maintenance. Appendices provide the report's study methodology and a checklist for measuring performance. Recent performance evaluations are also included. (GR)

Reproductions supplied by EDRS are the best that can be made
from the original document.

REPORT # 00-06

OFFICE OF THE LEGISLATIVE AUDITOR
STATE OF MINNESOTA

ED 444 347

A BEST PRACTICES REVIEW

Preventive Maintenance for Local Government Buildings

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Jody Hauer

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

EF 005 768

BEST COPY AVAILABLE

APRIL 2000

http://www.auditor.leg.state.mn.us/ped/bp/pe0006.htm

Preface

This report is a best practices review of preventive maintenance for local government buildings. It is the sixth in a series of best practices reviews conducted by the Office of the Legislative Auditor.

The 1994 Legislature established best practices reviews as a means of identifying effective and efficient practices in delivering local government services. The intent was to help local governments improve their service delivery by learning about successful practices in use by similar jurisdictions elsewhere.

Best practices reviews are different from audits. Typically, audits and program evaluations identify noncompliance and performance problems. By contrast, best practices reviews focus on what works well. They feature local governments that are delivering a public service cost-effectively.

A local government advisory council recommends topics for best practices reviews. By law, the advisory council comprises three members recommended by the Association of Minnesota Counties, three by the League of Minnesota Cities, two by the Association of Metropolitan Municipalities, and one each by the Minnesota Association of Townships and the Minnesota Association of School Administrators. The advisory council recommended the topic of preventive maintenance for buildings to the Legislative Audit Commission, which approved it in June 1999.

We acknowledge and appreciate help provided by numerous local government officials involved with maintaining, planning, and funding public buildings. Their expertise contributed greatly to the final report. Members of the Department of Children, Families, and Learning also provided data and assistance.

The report was researched and written by Jody Hauer (project manager), Valerie Bombach, Caryn Mohr, and Ann Masse. For readers with access to the Internet, this report and related material may be found over the World Wide Web at http://www.auditor.leg.state.mn.us/ped/2000/pe0006.htm.

St. Paul, Minnesota
April 12, 2000

Table of Contents

Page

SUMMARY ix

INTRODUCTION 1

1. BACKGROUND 3
   - What is Preventive Maintenance 3
   - The Value of Preventive Maintenance 5

2. BEST PRACTICES 9
   - Goals 10
   - Best Practices and Actions for Preventive Maintenance 11
     - Inventory Building Components and Assess Their Conditions 13
     - Build the Capacity for Ranking Maintenance Projects and Evaluating Their Costs 20
     - Plan Strategically for Preventive Maintenance in the Long- and Short-Term 29
     - Structure a Framework for Operating a Preventive Maintenance Program 43
     - Use Tools to Optimize the Preventive Maintenance Program 57
     - Advance the Competence of Maintenance Workers and Managers 69
     - Involve Appropriate Maintenance Personnel in Decision Making and in Communicating Building Needs 75

3. LOCAL GOVERNMENT USE OF PREVENTIVE MAINTENANCE 81
   - Scope and Structure of Preventive Maintenance Vary 82
   - Obstacles Limiting Preventive Maintenance 90
   - Funding Preventive Maintenance 96
   - Laws and Rules Affecting Local Governments' Preventive Maintenance 100

APPENDICES
   - A. Study Methodology 105
   - B. A Checklist for Measuring Performance 115

SUMMARY OF RECOMMENDATIONS 127

FURTHER READING 129

RECENT PROGRAM EVALUATIONS Back Cover

List of Tables and Figures

Tables Page

2.1 Practices Used by School Districts for Monitoring Building Conditions, 1998-99 16
2.2 Use of Life-Cycle Costs and Cost-Estimating Systems by School Districts, 1998-99 22
2.3 Elements of School Districts' Capital Plans, 1998-99 32
2.4 Use of Reserved Funds for Preventive Maintenance, 1999 33
2.5 Elements of Annual Building Maintenance Plans in School Districts, 1998-99 34
2.6 Preventive Maintenance Practices Used by Local Governments, 1999 44
2.7 School Districts' Indoor Air Quality (IAQ) Programs, 1998-99 48
2.8 Methods Used to Evaluate Preventive Maintenance, 1999 60
2.9 Training Required by School Districts for Maintenance Employees, 1998-99 70
2.10 Considering Maintenance Needs in School District Decision Making, 1998-99 76
3.1 Definitions of Facility Conditions 85
3.2 Oversight of Building Maintenance in Cities and Counties, 1999 88
3.3 Staffing for Preventive Maintenance in Local Governments, 1999 89
3.4 Obstacles to Performing Preventive Maintenance, 1999 92

Figures

1.1 Continuum of Maintenance for Buildings 4
2.1 Best Practices and Actions for Successful Preventive Maintenance 12
3.1 School Districts by Condition of Most Building Components, 1998-99 85
3.2 Average Deferred Maintenance by School District Headcount and Buildings' Size, 1998-99 86
3.3 Average Deferred Maintenance by Average Age of School Buildings, 1998-99 87
3.4 Seriousness of Funding-Related Obstacles to Preventive Maintenance, 1999 91
3.5 Maintenance Training Required by School Districts Reporting Lack of Training as an Obstacle to Preventive Maintenance, 1998-99 95

OLA
OFFICE OF THE LEGISLATIVE AUDITOR
STATE OF MINNESOTA

Preventive Maintenance for Local Government Buildings: A Best Practices Review

April 12, 2000

This review recommends best practices in managing preventive maintenance for buildings, and it profiles local jurisdictions currently using them.

This best practices review identifies seven strategic practices for effectively managing preventive maintenance of school district, city, and county buildings. The report recommends that local governments adopt these actions wherever appropriate.

Recommended Best Practices:

- Building managers should inventory building components and inspect their condition (p. 13 in the full report*).
- Building managers should set priorities among maintenance projects and evaluate projects' lifetime costs (p. 20).
- Local jurisdictions should plan and budget strategically for preventive maintenance in the long- and short-term (p. 29).
- Building managers should structure a framework for operating a preventive maintenance program, including checklists of preventive maintenance tasks (p. 43).
- Building managers should use tools, such as work-order systems, to optimize their preventive maintenance program (p. 57).
- Local jurisdictions should ensure that maintenance employees have appropriate training to competently complete their tasks (p. 69).
- Local officials should involve appropriate maintenance personnel when designing space and purchasing building components. Building managers should educate policymakers on building needs (p. 75).

In addition to recommending these best practices, the review found that:

- Well-planned preventive maintenance extends the useful life of building components such as roofs or heating and ventilation systems, thereby preserving taxpayer investments (p. 5).
- Although most Minnesota local governments report that they perform some preventive maintenance on their buildings, only about 15 percent have a comprehensive preventive maintenance program (p. 83).
- School districts with comprehensive preventive maintenance were more likely than other districts to report having most facility components in good condition (p. 84).
- Local governments reported that the greatest obstacles to preventive maintenance are competition for limited dollars, insufficient staff hours available, and levy limits (p. 90).

*For the full best practices report *Preventive Maintenance for Local Government Buildings* (#PE00-06), call 651/296-4708 or download from:

www.auditor.leg.state.mn.us/ped/2000/pe0006.htm.

BEST COPY AVAILABLE

Report Summary:

Preventive maintenance is regularly scheduled repair and maintenance needed to keep building components, such as heating-ventilation-air-conditioning (HVAC) systems, roofs, plumbing, and electrical systems, operating efficiently and to extend their useful life. Preventive maintenance includes periodic inspections, lubrication, calibrations, and equipment replacement. Replacing filters in an air-handling unit on a regular basis is an example of preventive maintenance.

Preventive maintenance extends the useful life of building components.

Effective preventive maintenance is a planned approach designed to avoid equipment breakdowns and prevent minor problems from escalating into major ones. By contrast, emergency and corrective maintenance occur when equipment fails, typically requiring more time and resources to correct problems.

Local governments should follow seven best practices for effective preventive maintenance.

1. Inventory Building Components and Assess Their Conditions

Before beginning preventive maintenance, building managers should inventory building components and their condition. Information on conditions helps identify needed maintenance. About 47 percent of Minnesota school districts (144 districts) reported in a 1999 survey that they keep a current list of most of their building components. Responding to a slightly different question, 24 percent of cities and counties (68 jurisdictions) reported they had an inventory of most of their building components' condition.

To control costs of assessing conditions, building managers should plan which building components to assess and how much to use experts with special diagnostic tools. For comparable data, building managers need standard assessment methods and trained workers.

***Example:** Hennepin County's Property Services Department requires ongoing inspections. For instance, building managers follow a roof inspection checklist twice a year looking for blistering, plugged drains, or damage to caulking. Every five years, consultants scan the roofs with infrared imaging equipment. Condition information allows estimating life expectancies for roofs and planning their maintenance.*

2. Build the Capacity for Ranking Maintenance Projects and Evaluating Their Costs

Because the need for maintenance can outpace available resources, building managers should use an objective process to set priorities among projects. About 58 percent of school districts (162 districts) indicating they perform preventive maintenance had a ranking process.

To make cost-effective decisions between replacing or continuing to maintain building components, building managers should use an evaluation tool, such as life-cycle costing. For reliable cost estimates, local officials should use standardized cost guides, contractors' estimates, or their own historical repair data. About 22 percent of school districts (60 districts) reported that they determined life-cycle costs for most components.

***Example:** The Anoka-Hennepin School District Buildings and Grounds Department developed a guide to estimate costs for maintenance projects common in the district's 43 buildings. The guide includes estimates for both labor and supplies, which are based on the district's historical cost data and updated yearly. It provides accurate data and avoids duplicating estimates for similar repairs.*

3. Plan Strategically for Preventive Maintenance in the Long- and Short-Term

Unless planned, maintenance tends to occur when equipment breaks—typically a more costly arrangement that interrupts use of the building. Local jurisdictions should look out a minimum of three years and develop facility plans to guide maintenance that meets their overall needs. Of those performing preventive maintenance, about 53 percent of school districts (155 districts) and 26 percent of cities and counties (52 jurisdictions) reported that they wrote long-range plans for building maintenance.

Jurisdictions need a capital improvement program with specific proposals to meet their buildings' capital needs. About 55 percent of school districts (165 districts) reported developing a capital plan for facility components that included provisions for preventive maintenance. Of the cities and counties that perform preventive maintenance, 57 percent (109 jurisdictions) said they sometimes or consistently have such plans.

Preventive maintenance requires linking maintenance plans with capital and operating budgets.

Based on the long-term plans, building managers should develop an annual maintenance work plan that lists expected projects and analyzes personnel needs. About two-thirds of school districts (191 districts) that perform preventive maintenance reported they had annual building maintenance plans, although the plans' completeness varied.

The work plan should be linked to yearly operating and capital budgets. Local jurisdictions should establish reserved accounts to fund major maintenance and renewal of buildings, such as tuckpointing brick exteriors. Of local jurisdictions that perform preventive maintenance, 9 percent of school districts (24 districts) and 20 percent of cities and counties (35 jurisdictions) reported relying consistently on reserved funds. Twenty-four counties reported consistently levying taxes for a "county building fund."

Example: *The Wabasha-Kellogg School District developed a five-year capital plan that lays out expected major building expenditures. District officials update the plan yearly based on the buildings and grounds supervisor's estimates of building needs and costs. To secure funding for buildings, each year the district allocates money to a reserved account for future capital projects.*

4. Structure a Framework for Operating a Preventive Maintenance Program

Building managers should coordinate preventive maintenance with other maintenance projects. Lodging responsibility for coordination with specific individuals enhances accountability.

Including every piece of every building system in a preventive maintenance program is prohibitively expensive. Building managers must decide which equipment to exclude, such as equipment that can be replaced inexpensively.

Another step is developing checklists of preventive maintenance tasks and their frequency. About 38 percent of school districts (115 districts) and 18 percent of cities and counties (51 jurisdictions) reported that they prepare checklists of preventive maintenance tasks for most building components.

Building managers should set a yearly timeline for preventive maintenance activities. About 52 percent of school districts (160 districts) and 32 percent of cities and counties (94 jurisdictions) schedule preventive maintenance tasks for most components according to manufacturers' standards or other set intervals.

Other practices include adopting written procedures for managing the program and implementing preventive maintenance activities to control indoor air quality.

Example: *In the city of North St. Paul, the building maintenance division follows checklists of preventive maintenance activities and uses handheld testing equipment during inspections. A schedule details maintenance to be performed and its frequency, including regularly changing filters and disinfecting HVAC components.*

Temperature sensors allow the maintenance foreman to assess how well the HVAC is functioning and make immediate adjustments.

5. Use Tools to Optimize the Preventive Maintenance Program

To get the most out of preventive maintenance, building managers should incorporate preventive tasks into their work-order system. Doing so controls maintenance jobs and provides a written work record.

Building managers also need a systematic way to keep maintenance records. This ranges from computerized maintenance-management systems to simple spreadsheets to manual records. About 21 percent of school districts (63 districts) and 16 percent of cities and counties (47 jurisdictions) reported that they keep comprehensive preventive maintenance records for most building components.

Local jurisdictions can avoid costs by considering maintenance needs up front.

To gauge how well a program is working, building managers should periodically evaluate their preventive maintenance program. They should also explore sharing maintenance expertise or equipment to gain efficiencies, improve services, and maximize the use of facilities.

***Example:** With five nearby school districts, the Foley School District formed an "education district" that jointly provides certain maintenance services. The education district's health and safety officer provides asbestos inspection, indoor air monitoring, and testing for lead in water, among other duties. By sharing costs, the six districts receive direct assistance for which they would otherwise have to employ additional staff or contract for services.*

6. Enhance the Competence of Maintenance Workers and Managers

Local jurisdictions should ensure that their maintenance employees receive training to competently complete their tasks. This includes training related to job safety. Further, building managers may need managerial training in addition to hands-on maintenance skills.

***Example:** Since 1994, the South St. Paul School District's part-time health and safety officer has held one-day safety training twice yearly for maintenance workers, in addition to numerous briefer safety meetings. Over this time, work-related injuries have decreased. When the district upgrades building systems, it trains workers to properly maintain them, thereby avoiding consultant fees for the maintenance.*

7. Involve Appropriate Maintenance Personnel in Decision Making and in Communicating Buildings' Needs

Local officials should include maintenance personnel in the early stages of the decision-making process when purchasing major components or designing space. Doing this helps avoid unnecessary costs as the design makes future maintenance needs explicit. In addition, building managers should develop an education strategy to inform their various audiences about building conditions, needed maintenance, and the consequences of deferring projects.

***Example:** When Aitkin County designed a new jail, maintenance personnel offered input on the proposed HVAC system, pointing out that the designed heating units had shorter life expectancies and greater fuel consumption than an alternative. After considering the overall costs of purchasing and operating the two choices, the county ultimately selected the alternative with lower lifetime costs.*

Introduction

This report examines best practices in managing preventive maintenance for buildings owned by Minnesota local governments. Preventive maintenance is regularly scheduled inspection, testing, and repair of building components intended to prolong a building's life and restore components' efficiency. Because of the great investment taxpayers have made in public buildings throughout the state, the question of how best to maintain them is an important one.

Preserving building systems is important because public buildings represent significant investments of tax dollars.

The report focuses on building maintenance activities of counties, cities, and school districts. We examined how extensively these jurisdictions practiced preventive maintenance and asked about obstacles limiting local governments' ability to perform preventive maintenance.

At the start of the project, we held a roundtable discussion to learn what local building managers, finance officers, and legislators viewed as important issues. The study included a review of literature on building maintenance published by a variety of groups, from the Association of School Business Officials International to the U.S. Army Corps of Engineers. We visited several local governments in different regions of the state to interview building maintenance managers and local finance officers on how they funded and performed preventive maintenance. In addition, representatives of various private sector firms involved with building maintenance spoke with us about their services.

Standards and guidelines published by organizations such as the Building Owners and Managers Association, the American Public Works Association, and the American Management Association, and information from recognized experts in facilities management such as Harvey H. Kaiser and Thomas A. Westerkamp, helped us define the best practices needed for successful preventive maintenance. Based on the work of these and many other authors, we identified measures of performance. The measures provided a framework for determining the extent of local government involvement in effective preventive maintenance programs.

As a way to learn more about preventive maintenance in Minnesota, we surveyed school districts, counties, large cities, and a sample of smaller cities. Survey results gave us a picture of which local governments reported using preventive maintenance consistently. They also allowed us to identify jurisdictions that appeared to be using preventive maintenance effectively and efficiently based on whether they met performance standards developed earlier in the study. We visited a small number of these jurisdictions. During these visits, local officials offered additional information on particular maintenance practices.

Throughout the review we relied on the advice and expertise of a technical advisory panel established at the outset of the project. The 11-member panel consisted of facility directors and finance officers representing counties, cities, and school districts; employees of companies involved with building maintenance issues; and a representative from the Department of Children, Families, and Learning. Members offered their professional input at various stages of our work. Appendix A lists the technical panel members and provides additional details on the methodology of the review.

This report has three chapters. In the first, we provide background information defining preventive maintenance and its value. Chapter 2 recommends best practices that local governments should take to achieve the goals of preventive maintenance. Based on survey data we collected, it describes the number of local governments that follow various best practices for preventive maintenance. The chapter also presents examples of Minnesota school districts, cities, and counties that use best practices in preventive maintenance for their buildings. Chapter 3 explains differences in local governments' use and management of preventive maintenance. It describes obstacles local governments believe limit their ability to perform preventive maintenance. The chapter also explains how local governments fund preventive maintenance and briefly describes the state's role in local building maintenance.

1

Background

SUMMARY

Preventive maintenance means extending the useful life of building systems through regularly scheduled inspections, adjustments, lubrication, testing, and replacements. Without preventive maintenance, emergency maintenance tends to predominate, tending to make buildings operate less efficiently.

This chapter provides background information on defining preventive maintenance for Minnesota's local government buildings. In this chapter we address the following questions:

- **What is preventive maintenance? How does it differ from other types of maintenance?**
- **What is the value of preventive maintenance?**

Information in this chapter comes from materials published by various individuals and organizations that have studied and performed building maintenance.

WHAT IS PREVENTIVE MAINTENANCE?

The intent of preventive maintenance is to extend the life of building components.

Minnesota taxpayers have a significant investment in buildings owned by local governments and school districts. Preserving these assets—including the buildings' roofing, plumbing, heating, ventilation, air conditioning, electrical systems, exteriors, and interiors—is a primary objective behind preventive maintenance.

Preventive maintenance means the regularly scheduled repair and maintenance needed to keep a building component operating at peak efficiency and extend its useful life.[1] It includes scheduled activities intended to prevent breakdowns, such as periodic inspections, lubrication, calibrations, and replacement of equipment. Replacing filters in an air-handling unit on a regularly scheduled basis is an example of preventive maintenance. Because prolonging the life of major building systems requires periodic replacement of equipment, preventive maintenance typically requires both capital and operating expenditures.

---

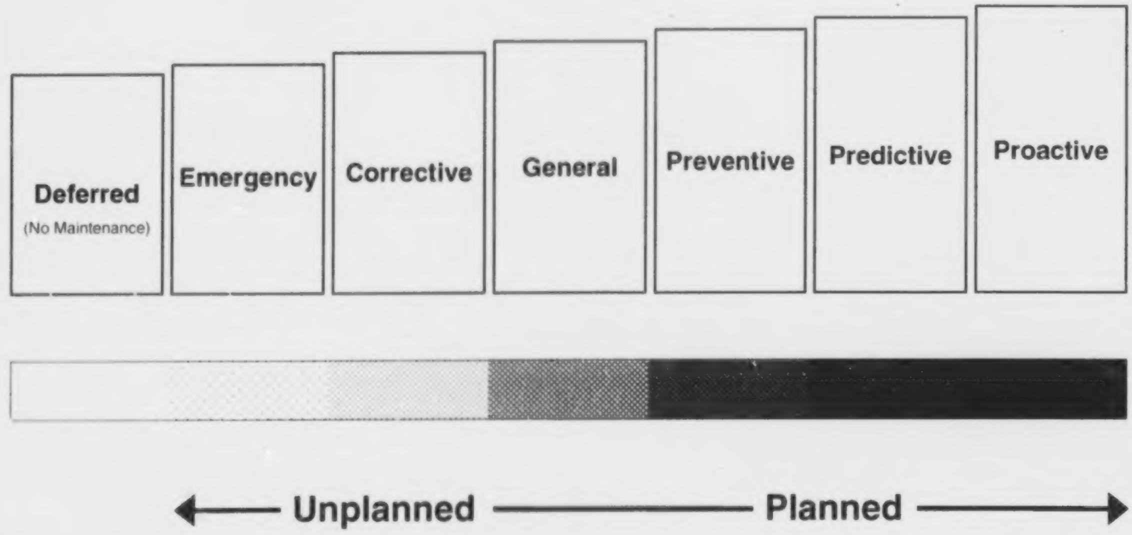
[1] Our study focused on preventive maintenance for local government-owned buildings and building components. It excluded maintenance for leased space, roads, and sewer or water systems. Except where otherwise specified, we did not examine maintenance of grounds, playgrounds, parking lots, or athletic facilities.

There are alternative definitions, however. Some believe, for instance, that vacuuming carpet is a form of preventive maintenance because, if done frequently, it minimizes carpet repairs and prolongs the carpet's life. For purposes of this study, we exclude daily custodial activities, such as vacuuming, mopping, emptying wastebaskets, moving furniture, and cleaning restrooms. Also excluded is work intended to expand the capacity of a building or upgrade it to change its designed use.

A continuum of building maintenance is illustrated by Figure 1.1. At one end is deferred maintenance, which occurs when projects are identified as necessary but put off due to lack of resources. Next along the continuum are unplanned activities including emergency maintenance, such as restoring lost electrical power, and corrective maintenance, such as fixing a broken window. Emergency and corrective maintenance occur as the need arises; neither is planned far in advance.

Planned maintenance follows on the continuum, although the maintenance categories are not mutually exclusive. General maintenance is the upkeep of building components to restore them to their original conditions or to keep them in good working condition. Preventive maintenance follows on the continuum.

Figure 1.1: Continuum of Maintenance for Buildings



SOURCE: Office of the Legislative Auditor.

As described earlier, preventive maintenance is a planned program of periodic inspections, adjustments, and replacements, and it is the focus of this report.

Preventive maintenance requires inspecting, adjusting, and replacing components on a regularly scheduled basis.

Although not addressed extensively in this study, predictive maintenance presents another degree of planned maintenance. It uses techniques, such as vibration analysis of moving parts while equipment is operating, to detect trends that indicate excessive wear. This allows repairs to be made before equipment fails, but only when conditions warrant the repair, not on a regularly scheduled basis as with preventive maintenance. Predictive maintenance helps avoid unnecessary overhauls when analysis indicates the equipment is in good condition and does not need work. One example is analyzing the vibration frequencies of fans or gears to detect changes in amplitude that may signal bearing damage or other degradation.[2]

A step beyond that is proactive maintenance, a highly structured practice that uses information from analyzing equipment to identify origins, not just symptoms, of equipment problems. Proactive maintenance would, for example, identify whether excessive wear resulted from defective installation, unsuitable design, or some other cause. Because it addresses the root sources of equipment problems, proactive maintenance eliminates recurring problems and the downtime and other costs associated with those recurrences.

THE VALUE OF PREVENTIVE MAINTENANCE

Many building-industry and facility-management groups, including the American Public Works Association, the Building Owners and Managers Association (BOMA) International, the Association of Physical Plant Administrators (now named the Association of Higher Education Facilities Officers), and the Association of School Business Officers agree on the benefits of well-planned preventive maintenance.[3] They advocate preventive maintenance for its effects on improving equipment's operating efficiency, preventing premature replacement of components, and avoiding interruptions for building occupants.

Preventive maintenance is widely thought to reduce long-term costs by maximizing the operating capacities of equipment, minimizing downtime, and avoiding breakdowns that would otherwise lead to higher repair costs later. Although we found no studies that quantified specific costs and benefits of a comprehensive preventive maintenance program for buildings, some studies demonstrate efficiencies of planned maintenance and others show the relationship

---

[2] R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance* (Kingston, MA: R. S. Means Company, Inc., 1996), 265.

[3] American Public Works Association (APWA), *Public Works Management Practices* (Chicago: APWA, August 1991), 64; David A. Avedesian, *How to Design and Manage Your Preventive Maintenance Program* (Washington D.C.: Building Owners and Managers Association International, 1996), 5-7; Rex O. Dillow, *Facilities Management: A Manual for Plant Administration* (Washington D.C.: Association of Physical Plant Administrators, 1984), III-101 to III-103; and Association of School Business Officers (ASBO) International, *School Facilities Maintenance and Operations Manual* (Reston, VA: ASBO International, 1988), 31.

BEST COPY AVAILABLE

between building maintenance and reducing building deterioration.[4] Studies within individual companies show savings in energy costs and repair costs, as well as reductions in equipment breakdowns, due to preventive maintenance.[5]

Preventive maintenance has been shown to save energy and reduce repair costs.

For instance, the preventive maintenance tasks of cleaning coils and replacing dirty filters in a heating, ventilation, and air-conditioning (HVAC) system have shown reduced energy costs for running an HVAC of 8 to 10 percent.[6] In a die-casting company that adopted preventive maintenance, equipment breakdowns went from being a common occurrence to constituting approximately 1 percent of scheduled operating time over a ten-year period. Further, maintenance efficiencies allowed the company to reduce its maintenance workforce from 15 to 8 employees during that time.[7] In another instance, by training maintenance workers in preventive maintenance, nine community colleges in California improved the efficiency of HVAC operations and saved an estimated 6 to 19 percent of their total annual energy bills, or $0.09 to $0.26 per square foot per year.[8]

As another example, a manufacturing company experienced a 33 percent net decrease in maintenance hours over a five-year period and reduced time on corrective maintenance after machine operators began performing preventive maintenance tasks.[9] A study of air-conditioning systems in five residences found that adequate cleaning of the condenser or evaporator coils could provide the same amount of cooling with 30 to 40 percent less energy consumption than inadequate cleaning.[10]

Also important are the potential effects of preventive maintenance on building occupants. Because of its impact on the condition of a building's components,

---

[4] Tim Stevens, "The Power of Prediction," *Industry Week* (July 4, 1994): 45-47; and Mitsuru Saito, ed., "Study of Building Deterioration," *Infrastructure Condition Assessment: Art, Science, and Practice* (New York: American Society of Civil Engineers, 1997), 7, 9.

[5] Some studies illustrate greater savings associated with predictive and proactive maintenance because of their more selective way of determining when service is needed. See: Association for Facilities Engineering, *Certified Plant Maintenance Manager Review Book* (Solon, OH: Engineer's Digest, 1999), 28; and Joseph J. Romm, *Lean and Clean Management: How to Boost Profits and Productivity by Reducing Pollution* (New York: Kodansha America, Inc., 1994), 155-159.

[6] Walter Johnston, "Preventive Maintenance and Energy," *Energy and Environmental Visions for the New Millennium: Proceedings of the 20th World Energy Engineering Congress* (November 19-21, 1997): 521-522.

[7] Charles F. Drake, "Preventive Maintenance is the Lowest Cost Way to Operate," *Die Casting Engineer* 42, no. 1 (January/February 1998): 45.

[8] Barry Abramson and Michael Magee, "Quantifying the Energy Benefits of HVAC Maintenance Training and Preventive Maintenance," *Energy Engineering* 96, no. 2 (1999): 54-55.

[9] J. W. Patterson, L. D. Fredendall, A. McGee, and W. J. Kennedy, "Adapting Total Productive Maintenance to Asten, Inc.," *Production Inventory Management Journal 1996,* summarized in Lawrence D. Fredendall, J. Wayne Patterson, William J. Kennedy, and Tom Griffin, "Maintenance: Modeling Its Strategic Impact," *Journal of Managerial Issues* 9, no. 4 (Pittsburg, KS: Pittsburg State University, Winter 1997): 443.

[10] "Study Reveals Maintenance Can Add Cooling Capacity, Save on Power Bills," *Air Conditioning, Heating & Refrigeration News* (August 28, 1986), summarized in Judy K. Johnson, "The Missing Link: Effective Maintenance," *Energy and Environmental Visions for the New Millennium: Proceedings of the 20th World Energy Engineering Congress* (November 19-21, 1997): 346.

BEST COPY AVAILABLE

preventive maintenance may indirectly affect occupants' productivity and health.[11] For example, a study of public school conditions in the District of Columbia found that, while controlling for other factors, students in schools with excellent building conditions had higher standardized achievement scores than students in schools with fair building conditions and even higher scores than students in schools with poor conditions.[12]

Preventive maintenance can indirectly but positively affect the productivity and health of building users.

As further described in Chapter 2 of this report, certain preventive maintenance can improve the quality of indoor air, and insufficient preventive maintenance can be detrimental to it. For instance, lack of preventive maintenance may result in roof leaks, creating conditions for mold growth and potentially affecting some users' respiratory systems. The costs of poor indoor air are potentially dramatic, as exemplified recently by the Capitol Square building in St. Paul, which had problems that forced the relocation of its occupants and led to its demolition in early 2000.

Maintaining good indoor air can have direct, positive effects on building occupants. As an example, one study quantified savings from improved worker productivity and health associated with making indoor air quality improvements in government, school, and other nonindustrial buildings. The study estimated that a one-time upgrade of HVAC systems, including the preventive maintenance required to sustain the upgrade over 20 years, would provide net benefits of $13.31 per square foot and $11,227 per worker.[13]

---

[11] Shalan Khandekar and Tom Tamblyn, "Relationships Between Air Quality and HVAC System Design, Operation and Maintenance Problems," *Proceedings of Indoor Air '90: The Fifth International Conference on Indoor Air Quality and Climate*, (1990): 11-12; Charlene W. Bayer, Sidney A. Crow, and John Fischer, "Impact of IAQ on Productivity and Satisfaction in the Learning Environment," *Causes of Indoor Air Quality Problems in Schools: Summary of Scientific Research*, Report prepared by the Energy Division of Oak Ridge National Laboratory (ORNL) for the U.S. Department of Energy (Oak Ridge, TN: ORNL, January 1999), 31-33; and A.N. Myhrvold, E. Olsen, and O. Lauridsen, "Indoor Environments in Schools—Pupil Health and Performance in Regard to CO_2 Concentrations," *Proceedings of Indoor Air '96: The Fifth International Conference on Indoor Air Quality and Climate*, (1996): 369-374.

[12] Maureen M. Edwards, "Building Conditions, Parental Involvement and Student Achievement in the D.C. Public School System" (Master's thesis, Georgetown University, May 1991), 40. The study controlled for factors such as mean income of school neighborhoods, school building age and type, and enrollment size.

[13] Dorgan Associates, Inc., Productivity and indoor environmental quality study, 1993, National Energy Management Institute, Alexandria, Virginia, and C. E. Dorgan, C. B. Dorgan, and M. S. Kanarek, Productivity benefits due to improved indoor air quality, 1995, National Energy Management Institute, Alexandria, Virginia, summarized in Chad B. Dorgan, Charles E. Dorgan, Marty S. Kanarek, and Alexander J. Willman, "Health and Productivity Benefits of Improved Indoor Air Quality," *ASHRAE Transactions 1998, Part I* 104 (Atlanta: ASHRAE, 1998), 1-9. The study assumed a 3 percent inflation rate. Indoor air quality was defined as including temperature, humidity, contaminants, and gaseous composition.

2

Best Practices

SUMMARY

Preventive maintenance requires strategic actions for prolonging the life of building components. As a base line for planning, building managers should prepare and periodically update an inventory of building components and their conditions. Management can then better identify maintenance needs, determine their costs, and set priorities. Well-structured preventive maintenance, incorporated into ongoing maintenance programs, offers the best chance for achieving intended results. Local jurisdictions have a responsibility to make sure their maintenance employees receive needed training, beyond occupational licensure requirements. For cost-effective decisions, local officials should include appropriate maintenance personnel in considering long-term maintenance needs in addition to initial project costs. Local jurisdictions around Minnesota offer examples of best practices in planning, funding, and performing preventive maintenance.

This chapter describes best practices in managing preventive maintenance for buildings. It lists the main goals of preventive maintenance as well as best practices and actions necessary to fulfill those goals. The chapter also features school districts, cities, and counties that demonstrate best practices in preventive maintenance. In this chapter we address the following questions:

- **What are the primary goals behind using preventive maintenance on local jurisdictions' buildings?**
- **What practices are necessary to fulfill the goals of preventive maintenance?**
- **What actions now in use by Minnesota school districts, cities, and counties illustrate those best practices?**

Many local jurisdictions around Minnesota demonstrate best practices in preventive maintenance.

We based the goals and best practices on guidelines from the building industry and maintenance organizations around the country. To validate the goals and practices, we discussed them with a technical advisory panel of 11 people involved with building maintenance.

Much of this chapter's data come from surveys we conducted of Minnesota school districts, cities, and counties. City and county representatives completed the surveys in the fall of 1999, and the data we report pertain to their practices as of that time. School district data pertain to the 1998-99 school year. We surveyed all 87 counties, the 96 cities with populations greater than 8,000, a stratified random sample of 200 smaller cities, and the 347 independent and special school districts.

The chapter presents survey data as reported by local jurisdiction representatives. We did not independently verify the accuracy or truthfulness of survey responses. Survey responses may not represent a jurisdiction as a whole; for instance, because we did not survey elected officials, their views may differ from those reported here. Appendix A contains additional information on the limitations of the survey data. Surveys mailed to school districts were longer than surveys sent to cities and counties, covering more aspects of preventive maintenance and in greater detail.[1]

Certain jurisdictions completed only some questions because the survey instructed those inactive in preventive maintenance to answer a limited number of questions. Consequently, some survey results pertain only to jurisdictions that indicated they actively perform preventive maintenance, and we report them accordingly. Of the 308 school districts responding to the survey, 96 percent (297 districts) answered questions pertaining only to jurisdictions performing preventive maintenance for at least some of their building components. Of the 246 cities and 73 counties responding to the survey, 64 percent of cities (158 cities) and 77 percent of counties (56 counties) answered questions pertaining to jurisdictions actively performing preventive maintenance. In cases when respondents chose to skip questions, we report percentages of only those who marked an answer.

In this chapter, the term "building managers" refers to those people responsible for overseeing the maintenance of the building. In some jurisdictions this is one individual, but in others it involves multiple people.

Information on examples of best practices used by local jurisdictions came from interviews we conducted while visiting various school districts, cities, and counties. For part of our analysis, we relied on school districts' expenditure data collected by the Minnesota Department of Children, Families, and Learning. (Appendix A provides additional information on the technical advisory panel's role, surveys of local jurisdictions, and the rest of the methodology for this study. Aggregate results from the surveys are available on our web site at http://www.auditor.leg.state.mn.us/ped/2000/pe0006.htm.)

GOALS

The goals of preventive maintenance provide a framework for identifying best practices.

We identified five key goals of preventive maintenance. Successful preventive maintenance programs should achieve these goals:

1. **Preserve taxpayers' investments in public buildings.**[2] Preventive maintenance can extend the life of building components, thus sustaining buildings' value and the significant tax dollars they represent.

---

[1] We collected more maintenance information from school districts because of particular legislative interest in the subject.

[2] David A. Avedesian, *How to Design and Manage Your Preventive Maintenance Program* (Washington D.C.: Building Owners and Managers Association International, 1996), 6; and Eric Melvin, *Plan, Predict, Prevent: How to Reinvest in Public Buildings* (Chicago: American Public Works Association, 1992) 1-2, 4.

2. **Help buildings function as they were intended and operate at peak efficiency, including minimizing energy consumption.**[3] Because preventive maintenance keeps equipment functioning as designed, it reduces inefficiencies in operations and energy usage.

3. **Prevent failures of building systems that would interrupt occupants' activities and the delivery of public services.**[4] Buildings that operate trouble-free allow public employees to do their jobs and serve the public. Because preventive maintenance includes regular inspections and replacement of equipment crucial to operating a building, maintenance staff reduce the problems that might otherwise lead to a breakdown in operations.

4. **Sustain a safe and healthful environment by keeping buildings and their components in good repair and structurally sound.**[5] Protecting the physical integrity of building components through preventive maintenance preserves a safe environment for employees and the public.

5. **Provide maintenance in ways that are cost-effective.**[6] Preventive maintenance can prevent minor problems from escalating into major system and equipment failures that result in costly repairs. In avoiding costs of major repairs, preventive maintenance creates efficiencies. Increasing preventive maintenance can reduce time spent reacting to crises, which is a more cost-effective way to operate buildings. Deferring preventive maintenance can generate higher costs over the long term.

BEST PRACTICES AND ACTIONS FOR PREVENTIVE MAINTENANCE

Seven best practices are necessary for successful preventive maintenance. Without these practices, a preventive maintenance program may not fulfill its goals. As shown in Figure 2.1, the seven best practices are:

1. **Inventory building components and assess their conditions.**

2. **Build the capacity for ranking maintenance projects and evaluating their costs.**

---

[3] Harvey H. Kaiser, *The Facilities Manager's Reference* (Kingston, MA: R. S. Means Company, Inc., 1989), 81; and American Public Works Association (APWA), *Public Works Management Practices* (Chicago: APWA, August 1991), 65.

[4] R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance* (Kingston, MA: R. S. Means Company, Inc., 1996), 264.

[5] APWA, *Public Works Management Practices*, 63; and International Code Council, Inc., *International Property Maintenance Code 1998* (Country Club Hills, IL: International Code Council, Inc., 1997), 9-10.

[6] Federal Facilities Council, Standing Committee on Operations and Maintenance, *Budgeting for Facilities Maintenance and Repair Activities* (Washington D.C.: National Academy Press, 1996), 29. Cost-effective denotes both economic efficiency and desirable results.

Figure 2.1: Best Practices and Actions for Successful Preventive Maintenance

1. Inventory Building Components and Assess Their Conditions

- Keep an accurate inventory of building components and equipment
- Plan building inspections
- Conduct the inspections methodically
- Assign condition ratings
- Update condition assessments regularly

2. Build the Capacity for Ranking Maintenance Projects and Evaluating Their Costs

- Set project priorities
- Use life-cycle costing or other tools to evaluate total costs and recurring equipment replacements

3. Plan Strategically for Preventive Maintenance in the Long- and Short-Term

- Develop a long-term facility plan
- Develop a capital improvement program
- Establish a reserved account for maintaining and renewing building components
- Develop an annual work plan
- Link work plan to annual budgets

4. Structure a Framework for Operating a Preventive Maintenance Program

- Coordinate the program with other maintenance
- Develop checklists of tasks and their frequency
- Schedule timelines to perform tasks
- Adopt written procedures to manage the program
- Follow an indoor air quality program

5. Use Tools to Optimize the Preventive Maintenance Program

- Use a work-order system
- Keep systematic records
- Evaluate the program
- Explore efficiencies of shared arrangements

6. Enhance the Competence of Maintenance Workers and Managers

- Require ongoing training to match duties performed
- Require additional training for building managers

7. Involve Appropriate Maintenance Personnel in Decision Making and in Communicating Buildings' Needs

- Consider maintenance needs when designing or purchasing building components and facilities
- Educate policymakers about buildings' needs and conditions

NOTE: The numbers do not imply a specific sequential order for performing the practices.

SOURCE: Office of the Legislative Auditor.

BEST COPY AVAILABLE

3. **Plan strategically for preventive maintenance in the long- and short-term.**
4. **Structure a framework for operating a preventive maintenance program.**
5. **Use tools to optimize the preventive maintenance program.**
6. **Advance the competence of maintenance workers and managers.**
7. **Involve appropriate maintenance personnel in decision making and in communicating buildings' needs.**

Following best practices helps meet the goals of preventive maintenance.

The remainder of this chapter defines the seven best practices and describes actions related to each. It also includes examples of school districts, cities, and counties that have put the actions into practice. Because every practice illustrated here may not be easily adopted by all jurisdictions, we try to identify the conditions under which the practices are most feasible.

By featuring specific local jurisdictions in this chapter we are not suggesting that they are the only ones using the best practices. Many others also use the practices. Nonetheless, the chapter highlights certain jurisdictions to illustrate how some have implemented the best practices related to preventive maintenance.

1. Inventory Building Components and Assess Their Conditions

A program of preventive maintenance begins with an inventory of a jurisdiction's facilities and basic information on their conditions. Collecting building-condition information is necessary to help building managers identify maintenance needs and quantify deferred maintenance.[7] Inventory and condition data also provide managers with the information needed to plan maintenance projects, set priorities among them, and estimate their costs.

RECOMMENDATION

As a prelude to preventive maintenance, building managers should oversee periodic inspections of buildings' conditions and create an inventory of buildings' components and equipment.[8]

---

[7] National Research Council, *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets* (Washington D.C.: National Academy Press, 1998), 43.

[8] Harvey H. Kaiser, *The Facilities Audit: A Process for Improving Facilities Conditions* (Alexandria, VA: APPA, The Association of Higher Education Facilities Officers, 1993), 2, 35, 37; and David G. Cotts, *The Facility Management Handbook*, 2d ed. (New York: American Management Association, 1999), 221, 226.

Keep an Accurate Inventory of Building Components and Equipment

An inventory is a reliable count of the various building components and equipment composing a jurisdiction's facilities. A complete inventory, periodically updated, offers an information base with which building managers can plan condition assessments and needed preventive maintenance.[9] Typically, information in the inventory should include the building components' condition and functional performance, as well as the equipment's age, usage, location, warranty information, and model type.[10]

From the survey, we learned that:

- **47 percent of school district respondents reported maintaining a current list of most of their building components.**

Cities and counties responded to a slightly different question. Their survey responses indicated that 24 percent of cities and counties maintain a current inventory of the condition and use of most of their building components.

Plan Building Inspections

Before inspecting buildings, building managers need to plan the inspection program. Because a building-condition assessment potentially involves substantial time and personnel, it can be costly. Proper planning of the inspection is the best way to control its costs.[11]

Good planning controls inspection costs.

Building managers should determine in advance the scope of the program, that is, which buildings and components to inspect, if not all of them.[12] They should know what information to record, including maintenance deficiencies such as code violations.[13] In addition, managers need to decide whether in-house employees can conduct the inspections or whether certain building systems require specialized knowledge that extends beyond in-house expertise. For example, to adequately assess a building's structural condition, a structural engineer should participate.[14]

Deciding how to store and manage the volume of data collected during inspections is also important in the planning stage. Without this step, staff may find it difficult to use the inspection information and derive little value from it.

---

[9] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 31.

[10] Association of School Business Officials (ASBO) International, *School Facilities Maintenance and Operations Manual* (Reston, VA: ASBO International, 1988), 31.

[11] APWA and Building Research Board of the National Research Council, *Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings* (Chicago: APWA, 1991), 14.

[12] Melvin, *Plan, Predict, Prevent*, 19-20.

[13] Kaiser, *The Facilities Audit*, 2, 23; and Cotts, *The Facility Management Handbook*, 226.

[14] American Society of Civil Engineers, *Guideline for Structural Condition Assessment of Existing Buildings* (New York: American Society of Civil Engineers, 1991), 4, 6.

As part of the planning, a timetable for the inspections is necessary. Building managers should coordinate inspections in ways that avoid disrupting building occupants.[15] To do this, the schedule could include inspection times when there are fewer building occupants, such as after normal business hours or during breaks in the school-year calendar.

Conduct the Inspections Methodically

A methodical approach to building audits improves data consistency from building to building and over time.[16] Using standardized methods, condition data collected one year can be reliably compared to data collected in subsequent years. Written guidelines can also help provide consistency in inspection methods, particularly when multiple inspectors are involved. As shown in Table 2.1:

- **46 percent of school districts responding to the survey reported that they standardize their building inspections to achieve consistency; a quarter follow written guidelines in performing building assessments.**[17]

In addition, building managers should design inspection forms to help inspectors observe building components logically and record data uniformly.[18] With standardized checklists of the components, inspectors are more likely to collect consistent information and complete thorough inspections.[19]

Standardizing inspections increases the consistency of data on building conditions.

By themselves, however, standard checklists are insufficient unless they are used by personnel with the knowledge to identify the root causes of building deficiencies.[20] Training inspectors on the use of standard checklists helps improve accuracy and diminish the subjectivity of individuals' judgments.[21] Table 2.1 shows that:

- **68 percent of school districts responding to the survey reported that they train employees to identify maintenance needs for monitoring building conditions.**[22]

Although visual inspection is the primary way to conduct building audits, inspectors may need diagnostic tools to supplement their observations.[23] For instance, infrared scanning equipment helps detect wet insulation, air leaks in roofing systems, and loose electrical connections. The need for diagnostic tools

---

[15] Kaiser, *The Facilities Audit*, 18-21.

[16] *Ibid.*, 9.

[17] We did not collect similar data from cities and counties.

[18] For examples of a standard form see: Kaiser, *The Facilities Audit*, 24 or R. S. Means Company, Inc., *Facilities Maintenance & Repair Cost Data 1998* (Kingston, MA: R. S. Means Company, Inc., 1998), IV-9 to IV-11.

[19] National Research Council, *Stewardship of Federal Facilities*, 44; and Federal Facilities Council, *Budgeting for Facilities Maintenance and Repair Activities*, 31.

[20] National Research Council, *Stewardship of Federal Facilities*, 44.

[21] Kaiser, *The Facilities Audit*, 20.

[22] We did not collect similar data from cities and counties.

[23] Federal Facilities Council, *Budgeting for Facilities Maintenance and Repair Activities*, 26.

Table 2.1: Practices Used by School Districts for Monitoring Building Conditions, 1998-99

Practice	Percent of School Districts (*N*=305)
Monitor building conditions in the district	90.5%
Assess the condition of buildings and major components at least once every three years	83.3
Train employees to identify maintenance needs	67.9
Analyze the remaining useful life of building components	54.8
Keep a current list of building components and equipment	52.5
Rely on standardized inspections for consistent results over time	45.6
Use written guidelines to perform the assessments	23.9

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

may require hiring specialists with expertise in using the tools and interpreting their results. In more sophisticated building systems, built-in sensors collect data beyond what can be obtained via human observation.

Assign Condition Ratings

Using information from the inspection, building managers should assign condition ratings to the inspected items.[24] The ratings should be objective and based on a standardized scale that reflects condition changes. A scale may be a simple one, such as a good-fair-poor ranking. Or, depending on local needs, it may be more sophisticated, using a numerical index with many gradations. Ratings should indicate whether some corrective action is warranted. Over time, the condition ratings reveal rates of deterioration or, if used in combination with ongoing maintenance, show how well maintenance efforts have sustained the components' condition.[25]

Building condition data need to be updated periodically.

Update Condition Assessments Regularly

To reflect changes in square footage, value, building condition, and maintenance practices, building managers should regularly update information on building conditions. Some authorities suggest annual reinspections.[26] This may not be realistic for all jurisdictions, however. Inspection frequency will depend on the type and use of the building, type and condition of building systems and materials, rate of deterioration, and costs of the jurisdiction's inspection program.[27] With ongoing inspections, and a system for keeping good records, building managers can document building conditions over time. As Table 2.1 showed earlier:

---

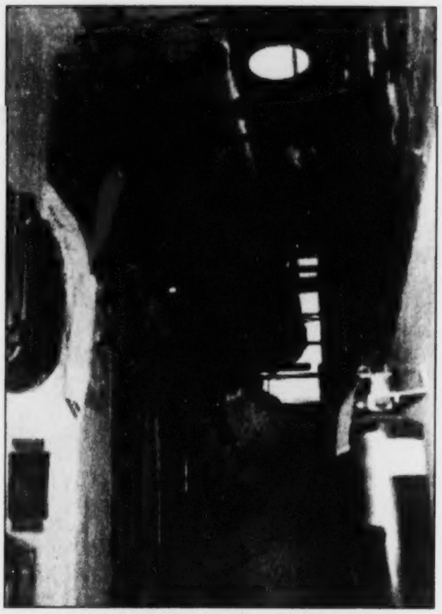
[24] *Ibid.*, 25; and Melvin, *Plan, Predict, Prevent*, 20.

[25] Federal Facilities Council, *Budgeting for Facilities Maintenance and Repair Activities*, 25, 31.

[26] Kaiser, *The Facilities Manager's Reference*, 102; and Applied Management Engineering, PC and Sean C. Rush, *Managing the Facilities Portfolio: A Practical Approach to Institutional Facility Renewal and Deferred Maintenance* (Washington D.C.: National Association of College and University Business Officers, 1991), 94.

- **More than 83 percent of school districts responding to the survey reported that they assess building conditions at least once every three years.**[28]

As noted previously and depicted in Table 2.1, however, fewer school districts keep a current list of their building components and equipment or use standardized inspections for consistency in results over time. Consequently, their condition assessments may be less comprehensive or useful than other districts that do these activities.



Inspecting building components is an important part of preventive maintenance.

Examples Related to Assessing Building Conditions

Hennepin County's Condition Assessments

While inspecting roofs, Hennepin County building managers use an inspection checklist.

Hennepin County's Property Services Department manages about 95 county-owned and leased buildings, which represent more than 4.6 million square feet. As part of its Facilities Management Plan, the department requires each of its building managers to inspect building conditions on an ongoing basis throughout the year. Inspectors receive training on what to look for and how to assess whether equipment conditions are critical, could damage other components, or simply require routine repair. Training helps in collecting consistent information from building to building and over time.

Using roofs as an example, the building managers in charge visually inspect each roof twice a year. They follow a roof inspection checklist looking for debris, blistering, plugged drains, and damage to accessories and caulking, such as cracked sealants or dismantled metal flashing. While inspecting, the building managers check off each roof element, indicating whether they discovered problems. If they find roof blistering, for instance, the inspection checklist has space for recording the number and average length of the blisters. Along with each checklist is a summary sheet the building manager uses to comment on needed repair activities and their costs.

---

[27] Melvin, *Plan, Predict, Prevent*, 28; and Federal Facilities Council, *Budgeting for Facilities Maintenance and Repair Activities*, 25.

[28] We did not collect similar data from cities and counties.

The maintenance inspection report becomes part of the roof history file kept for all buildings. This file might also contain items such as the manufacturer's specifications and warranties, original and as-built drawings, and reports of any corrective measures taken if leaks occurred. The information forms the basis for tracking roof conditions over time, identifying roof needs, and justifying budget requests.

In addition to the semiannual roof inspections, the Property Services Department hires roofing consultants approximately every five years to detect problems unseen by observation alone. The consultants scan roofs on all county-owned buildings with infrared imaging equipment; they provide detailed reports with damage statistics and photographs noting problem areas. Together with the information from the county staff's visual inspections, the consultant's data allow the department to estimate roof life expectancies and set priorities for repairs or roof replacements.

At a cost of approximately $50,000 spent every five years, which amounts to less than a tenth of a cent per square foot of county space, the consultant's information provides assurance that hidden problems are not lurking. The Property Services Department follows a similar process for other major building components.

To provide a base line of complete, floor-by-floor condition information, the Property Services Department has contracted with a number of firms to conduct building-condition audits in each building. Using information from the department on which components to audit, an architectural firm helped develop an audit form. Data from the form will interface with the county's computer-drawn floor plans. The one-time cost for developing the audit form and contracting to collect the data with structural, architectural, mechanical, and roofing experts is $205,000, or about three-tenths of a cent per square foot.

Accurate, current records of building conditions are important for planning maintenance projects and diagnosing when components will need replacement. For similar benefits, other jurisdictions would have to develop inspection forms for their major building components, schedule periodic inspections, and hire specialists as needed. Even smaller jurisdictions are likely to justify the time involved, and the cost of periodically hiring building consultants, with savings generated by averting severe or recurring building problems.

For more information contact:
Gary Grufman
Hennepin County Facilities Manager
612/348-3825

Worthington School District's Condition Assessments

The Worthington School District maintains approximately 402,000 square feet of building space (among the larger square footages for districts in the state). As part of the district's budgeting and planning process, the maintenance director annually assesses the condition of the district's buildings and grounds. School officials use the audit findings to estimate maintenance and repair costs for the coming year, as well as update their five-year capital plan.

The school district conducted a comprehensive facility audit in 1994, which included retaining code officials and technical experts to assess fire and building code compliance, evaluate indoor air quality, and estimate costs for upgrades to improve accessibility for disabled persons. School officials use the information as a base line against which to compare building improvements and deterioration.

A 1994 comprehensive facility audit in the Worthington School District provides a base line for comparing building conditions over time.

Since the comprehensive audit, the maintenance director has conducted annual audits so school officials have the most current information on building conditions prior to developing their budgets. School principals are present during the inspections of their buildings to provide insight and remain informed on system problems.

Using maintenance checklists and repair records, the maintenance director and maintenance personnel methodically assess the components of each building. The inspection includes testing boiler and cooling tower components, as well as ventilation systems, to ensure they are functioning correctly. If the audit reveals a system deficiency requiring large expenditures to correct, the maintenance director retains consultants with diagnostic equipment to verify the severity of the problem, its urgency for repair or replacement, and to estimate costs.

The maintenance director records audit findings, along with repair estimates, for each building and compares the information against the district's five-year capital plan from the previous year. For smaller repairs, the maintenance director uses the district's historical records to estimate repair costs. The maintenance director notes any changes in conditions from the previous year and prioritizes maintenance activities and repairs for the coming year. Using the audit findings, school officials revise plans for capital renewal and funding. The findings also help the maintenance director develop more accurate cost estimates for maintenance operations, supplies, and personnel resources for the coming year.

School officials believe the several days of personnel time and the costs of occasionally retaining consultants are worth the benefits of detecting system problems before they develop into larger and more expensive ones. Jurisdictions considering implementing similar building assessments should first determine the scope of the program, then compile an inventory of their building components, develop a record keeping system, and retain knowledgeable personnel to conduct the audits and diagnose system problems.

For more information contact:
David Skog
Worthington School District Director of Management Services
507/372-2172

Other jurisdictions we visited demonstrated best practices for assessing building conditions. Some are listed here along with contact names.

City of Brooklyn Park, Steve Lawrence, Central Services Superintendent, 763/493-8028;
Duluth School District, Kerry Leider, Director, Facilities and Risk Management, 218/723-4118.

2. Build the Capacity for Ranking Maintenance Projects and Evaluating Their Costs

To operate buildings as they were intended and in a cost-effective manner, active planning of building maintenance is necessary.[29] Adequate planning involves setting project priorities to target resources toward the highest needs. It also requires analytical tools to determine components' full costs—including expected maintenance—over their projected lifetimes.

RECOMMENDATION

As building managers determine what maintenance projects are needed, they should use an objective process for setting priorities among them. For cost-effectiveness, building managers should calculate total costs over the expected lifetime of equipment and facilities.

Set Project Priorities

Because maintenance needs can outpace available resources, good planning requires a process for ranking maintenance projects—including preventive maintenance, general maintenance, and projects necessary to correct deficiencies.[30] A ranking process recognizes that not all projects share equal importance. For instance, some projects left undone would involve too great a risk to building occupants' safety or could result in premature and expensive equipment failure. From the survey we learned that:

- **Of school districts indicating they actively perform preventive maintenance, 58 percent (162 districts) have a process for ranking the importance of preventive maintenance projects.**[31]

---

[29] U.S. Advisory Commission on Intergovernmental Relations (ACIR) and U.S. Army Corps of Engineers, *High Performance Public Works: A New Federal Infrastructure Investment Strategy for America* (Washington D.C.: U.S. ACIR, November 1993), 30.

[30] Melvin, *Plan, Predict, Prevent*, 26; and Kaiser, *The Facilities Audit*, 27.

[31] We did not collect similar data from cities and counties.

The danger in assigning lower priorities lies in the risk that less important projects left unattended eventually grow in urgency. Because delayed projects may pose larger future problems, building managers should understand and inform decision makers of the negative consequences of continually putting off the projects. They should also assign a time when work should start on the lower-priority projects.[32]

To set priorities, building managers should use objective criteria to sort out the relative importance of each project.[33] Objective criteria not only help methodically select projects, they also make apparent to building occupants why certain projects precede others.

The criteria should indicate the urgency of each project.[34] For instance, conditions that pose no immediate threat but may endanger the future integrity of other building components could receive somewhat lower priority than those that threaten occupants' safety. A project's cost, environmental concerns, and the need to comply with building codes are other factors that may influence project priorities.[35]

Depending on buildings' uses, a single jurisdiction may have multiple priority systems for ranking projects.[36] Projects a building manager might classify as top priority for a high-occupancy building might receive lower priority for buildings used primarily for warehousing.

Life-cycle costs include maintenance and energy costs, as well as purchase price.

Use Life-Cycle Costing or Other Tools to Evaluate Total Costs

Building managers should use an evaluation tool, such as life-cycle costing, to make cost-effective decisions on whether to replace or maintain building systems and equipment.[37] Estimating life-cycle costs involves determining a building system's total cost—not only its initial purchase price, but also the annual maintenance, repair, and energy costs over its expected life span, and its salvage value. The calculation requires some method of accounting for the time value of money, that is, estimating the present value of future dollars.[38]

Other evaluation tools are also useful. Methods such as calculating a benefit-to-cost ratio help measure the economic performance of investments in building systems.[39]

---

32 Melvin, *Plan, Predict, Prevent*, 27.

33 Federal Facilities Council, *Budgeting for Facilities Maintenance and Repair Activities*, 26.

34 Kaiser, *The Facilities Audit*, 27-28.

35 Federal Facilities Council, *Budgeting for Facilities Maintenance and Repair Activities*, 26.

36 Melvin, *Plan, Predict, Prevent*, 26.

37 APWA and National Research Council, *Committing to the Cost of Ownership*, 21; and U.S. ACIR and U.S. Army Corps of Engineers, *High Performance Public Works*, 31.

38 R. S. Means Company, Inc., *Facilities Maintenance & Repair Cost Data 1998* (Kingston, MA: R. S. Means Company, Inc., 1998), V3 - V7.

39 American Society for Testing and Materials (ASTM), *Standard Guide for Selecting Economic Methods for Evaluating Investments in Buildings and Building Systems E 1185-93* (Philadelphia: ASTM, 1993), 407.

According to the analysis,

- **22 percent of the school districts responding to the survey reported that they determined life-cycle costs for most building components.**[40]

Table 2.2 shows that most districts estimated life-cycle costs for at least some of their building components.

Table 2.2: Use of Life-Cycle Costs and Cost-Estimating Systems by School Districts, 1998-99

Practice	For Most Building Components	For Some Building Components	Practice is Not Used
Determine life-cycle costs (*N*=272)	22.1%	44.5%	33.5%
Calculate costs with a cost-estimating system (*N*=275)	33.5	45.5	21.1

With estimates of life-cycle costs, building managers can compare a range of alternatives and decide whether continuing to repair a component, deferring its maintenance, or replacing it is more economical. Such comparisons also help in choosing replacement equipment. Life-cycle costs allow building managers to time repairs knowing the overall costs of completing certain projects ahead of others.

Reliable cost data provide useful estimates of project costs.

When determining life-cycle costs it is important to use standardized cost data for reliable estimates.[41] Contractors' estimates and published cost guides prepared by professional organizations are useful for accurate cost estimates.[42] A jurisdiction's own historical maintenance and repair data can also help, if such data has been kept over time. As shown in Table 2.2, one-third of school districts reported they use a cost-estimating system for most of their building components.

Examples Related to Ranking Projects and Evaluating Their Costs

Foley School District's Use of Life-Cycle Costs

The Foley Public School District uses life-cycle costs of building components to make economical building decisions. Information from evaluating total costs of building components has helped the buildings supervisor make recommendations on replacing or continuing to repair certain equipment. The district also analyzed long-term costs for an energy-management system for its buildings.

---

[40] We did not collect similar data from cities and counties.

[41] National Research Council, *Stewardship of Federal Facilities*, 43.

[42] R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 312, 315; and APWA and National Research Council, *Committing to the Cost of Ownership*, 22. For instance, two documents that publish cost data yearly for various maintenance projects are (1) *The Whitestone Building Maintenance and Repair Cost Reference* published by Whitestone Research and (2) *Facilities Maintenance & Repair Cost Data* published by R. S. Means Company, Inc.

When the rubber roof on the Foley elementary school leaked, even after the original roof installers repaired it, the buildings supervisor called in several companies for repair estimates. The estimates ranged from $10,000 to $15,000 with two firms estimating the roof would last only two to four years and another saying the existing roof was beyond repair. The school district weighed the costs of the expected short-lived repairs and the potential for water problems (including the possibilities of mold and problems with indoor air quality) against the $2 per square foot costs of a new tapered roof plus maintenance over 20 or more years. Ultimately, the district decided to replace the roof.

In determining whether to enter into an energy-management contract, the school district examined projected utility costs over a ten-year period. The school board compared costs of making certain building improvements with revenues from energy savings the district could expect from the improvements. After paring away some improvements the board thought too costly, it approved a ten-year contract with approximately $500,000 of improvements. The district is midway through the ten-year period and has saved somewhat more than it originally projected. Improvements included replacing lighting with more energy-efficient bulbs, adding a pool cover to control water temperatures, and installing a computerized system for monitoring heating, ventilation, and air-conditioning (HVAC) equipment.

An energy-management system provides real-time information on HVAC operations throughout the building.

In addition to the energy savings, the computerized energy-management system saves time and offers operating efficiencies. A single computer terminal provides temperature and air pressure readings throughout the building. Sensors measure current conditions for air-handling units, the boiler, and variable speed motors. When building problems occur, the building supervisor has immediate access to information that can help pinpoint the trouble, leading to faster resolutions of HVAC problems. In addition, he can retrieve the data from remote locations, which is helpful for monitoring conditions when the school holds events after normal school hours.

When deliberating over the energy-management contract, the Foley School District was careful to approve only those improvements that decision makers believed would produce sufficient payback within ten years. The Foley School District is among the top one-third of Minnesota school districts in terms of square footage, but similar contracts may be beneficial in jurisdictions of other sizes that have not already taken steps to manage their buildings' energy efficiency. Jurisdictions considering such contracts must take care to use estimates that account for mild-weather years when heating or cooling costs could be lower than expected.

For more information contact:
Darwin Fleck
Foley School District Supervisor of Buildings, Grounds, and Custodial
320/968-7246

Norman County West School District's Maintenance Priorities and Use of Life-Cycle Costs

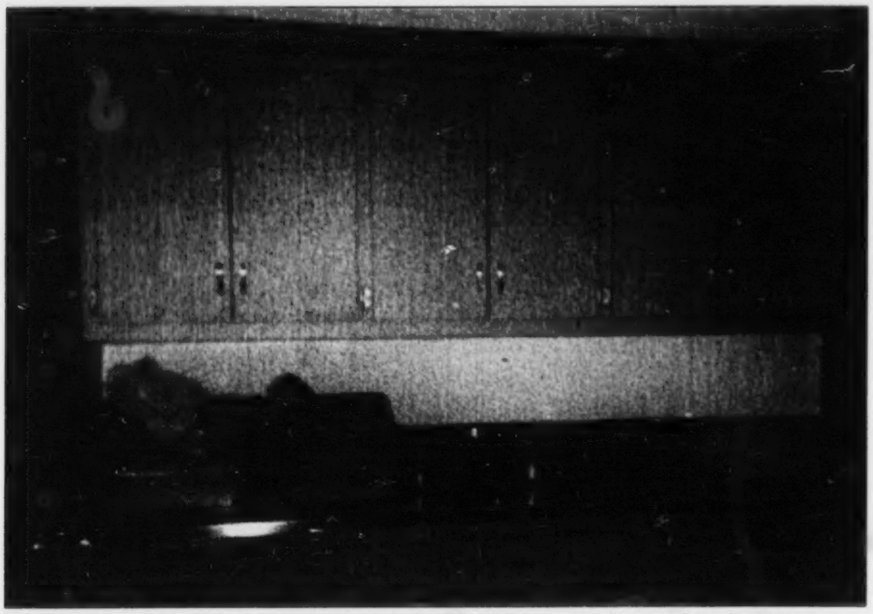
Norman County West School District's high-priority projects are deficiencies that could damage other building components.

In the Norman County West School District, the superintendent meets with the head custodians to generate an annual list of major and minor maintenance projects for each of the district's two buildings. (The district's square footage is among the smallest one-third of school district square footages in the state.) During this process, custodians provide their assessment of general building conditions and identify specific maintenance needs for their buildings. To help decide priorities, the superintendent also consults with the school principals to hear what maintenance projects could further their educational objectives for the year. Major projects from the list become part of the district's five-year capital plan; minor projects are placed in a shorter-range operating plan.

As a result of this annual planning, the school district is able to weigh projects against one another and determine in what order it should complete them. The district considers among its highest needs those projects that affect other building systems. As an example, a roofing project at the high school took precedence over other projects because roof leaks were damaging other equipment. The district waited to replace ceiling tiles until after having a new rubber roof membrane installed.

The school district's project planning also allows the school board to consider all capital project requests at one time. This is preferable to having requests considered on a project-by-project basis throughout the year, which had prevented board members from having a full picture of district needs and from understanding which projects were of greatest immediacy.

Considering a range of maintenance projects at one time allows for more economical decision making. For instance, when the high school home economics room needed cupboards, the school district opted to use the same contractor to also replace cupboards in the school's kitchen. Because the contractor achieved some economies of scale in purchasing materials and by coming on site for the joint project instead of at two separate times, savings were passed on to the district. The superintendent estimates the district may have saved up to 50 percent of project costs by having two jobs done simultaneously through one contractor.



The school district chose low-maintenance construction materials to reduce long-term maintenance costs.

As part of its planning, the school district considers what future maintenance needs add to the cost of a project. When choosing construction materials for the cupboards mentioned above, as an example, the district selected a more durable finish from among its options. Not only are the cupboards expected to last longer, but also custodians will not have to spend time refinishing cupboard surfaces as in the past because the finish requires neither paint nor polyurethane. By considering maintenance costs, the district made its investment based on the equipment's true costs over time, not only the initial purchase price.

For more information contact:
George Bates
Norman County West School District Superintendent
218/456-2151

Worthington School District's Use of Life-Cycle Costs

School officials in the Worthington School District consider life-cycle costs and assess the remaining useful life of building components when planning new construction and system upgrades or repairing or replacing system components. To make accurate estimates, maintenance personnel consistently record repair and inventory supply costs.

When confronted with replacing old, deteriorating systems, school officials obtain professional estimates for purchasing new components and then factor in projected maintenance and energy costs over the expected life of the system. The district maintains comprehensive records of its annual maintenance and repair expenses, utility costs, system conditions, and consultants' estimates of the expected remaining useful life of major building components. School officials use these records to calculate total costs (adjusted for inflation), compare alternatives for repairing or replacing, and to coordinate projects.

Records of repair and energy costs allow Worthington School District officials to calculate life-cycle costs.

Because of the expected remaining life of two Worthington school buildings built during the 1930s and 1940s, the school board proposed constructing a new elementary school rather than continuing to repair the old school buildings. Due to multiple system failures and structural problems, such as plumbing leaks and settling walls, school officials determined that it was not cost-effective to replace the old systems or incur expenses for either upgrading disability access or improving indoor air quality in the old buildings.

According to Worthington school officials, the costs for developing the life-cycle cost estimates for new components are minimal; the estimates prove useful for setting priorities among projects and planning capital expenditures. For valid comparisons among proposed projects, jurisdictions must maintain accurate records of operations and energy expenses.

For more information contact:
David Skog
Worthington School District Director of Management Services
507/372-2172

Wabasha-Kellogg School District's Maintenance Priorities

The Wabasha-Kellogg School District maintains approximately 148,000 square feet of building space (among the medium-size square footages for districts in the state). As part of the district's planning process, school officials use criteria such as safety to rank maintenance projects according to their importance. Setting project priorities allows school officials to schedule project timelines and direct personnel and financial resources towards correcting the most urgent building deficiencies.

To determine the order for completing maintenance projects, the buildings and grounds supervisor and school officials use several criteria. Deficiencies that threaten the safety or health of building occupants are highest priority and receive immediate attention. Because maintenance personnel actively monitor building conditions and perform preventive maintenance, the district rarely encounters urgent situations.

Among remaining projects, school officials assign a high priority to maintenance projects that prevent system failures or school closings. Projects to ensure compliance with state and federal mandates, such as maintaining disabled-access equipment or fire extinguishing systems and projects to improve and monitor indoor air quality follow in level of importance. Because some projects are best performed when school is not in session, the ranking criteria include setting project priorities around school-year breaks. All remaining maintenance and repair projects are assigned lower priority, unless a minor building deficiency becomes urgent. Maintaining building systems takes precedence over grooming athletic fields.

A priority system helps building managers in the Wabasha-Kellogg School District set project schedules and allocate resources.

Because of limited staff resources, school officials contract for many projects to give in-house personnel time to complete scheduled preventive maintenance and general custodial tasks. The availability of local contract labor, vendor cost estimates, and availability of funds generally determine the scheduling of remaining projects. Unusually low price quotes could move a lower-priority project up the list and advance its scheduled completion date.

Wabasha-Kellogg school officials believe their maintenance priorities help them plan for projects and result in more efficient use of resources by guiding daily maintenance activities. For a ranking process that helps avert potential building disasters, jurisdictions need objective criteria that distinguish crucial projects from others and that are applied uniformly.

For more information contact:
Larry Kronebusch
Wabasha-Kellogg School District Buildings and Grounds Supervisor
651/565-3559 ext.203

Anoka-Hennepin School District's Standardized Cost Estimates

The Anoka-Hennepin School District Buildings and Grounds Department maintains approximately 4.5 million square feet of building space (among the largest square footages for districts in the state). The district combines districtwide and school site-based approaches in maintaining its 43 buildings. To help department personnel and site-based building supervisors evaluate building repairs and improvements, the department developed a guide to estimate costs.

The guide contains estimates for maintenance and repair projects in 18 different subject areas, such as technology, electrical systems, and blacktop and concrete work. Depending on the project, estimates specify costs per square foot or yard, per unit, or per system, and include both labor and supplies. For instance, district costs to move or add fire-sprinkler heads are approximately $300 for each head. Estimates for some projects, such as replacing central air-conditioning systems, provide only a base line for minimum costs and instruct users to seek department assistance for precise estimates.

The guide also instructs users to consider additional items for certain projects. For instance, when planning to add or move a wall, building supervisors must also consider any costs for moving fire sprinkler heads, electrical switches, and sewer pipes. The department requires users to develop estimates for larger projects, such as replacing roofing or HVAC components, on an individual basis.

A guide to cost estimates saves time in the Anoka-Hennepin School District.

Because the school district maintains buildings using site-based management, the department developed the guide to help building supervisors estimate project budgets and prepare their annual budgets. The department also uses the guide to evaluate outside contractors' work proposals. To develop the guide, the department used the district's historical cost data, and it annually updates the estimates to reflect changes in actual costs or inflation.

School officials credit the guide as a useful, time-saving resource. By sharing project cost data, the guide reduces time spent obtaining consultants' estimates for similar projects. Jurisdictions with a low volume of recurring repairs may not realize similar benefits; cost estimates may become too outdated for valid comparisons. Updating the guide requires about two hours a year; the district's computer maintenance management system and comprehensive repair records minimize the time involved. To develop similar guides, jurisdictions need historical maintenance costs or access to other reliable sources of cost data.

For more information contact:

Louis Klingelhoets
Anoka-Hennepin School District Director of Buildings and Grounds
763/506-1228

Other jurisdictions we visited demonstrated best practices for ranking maintenance projects or evaluating their costs. Some are listed here along with contact names.

City of Melrose, Don Salzmann, Public Works Director, 320/256-4666 or Rose Ann Inderrieden, City Administrator, 320/256-4278;
Hennepin County, Gary Grufman, Facilities Manager, 612/348-3825

3. Plan Strategically for Preventive Maintenance in the Long- and Short-Term

To get optimum benefits from preventive maintenance, local jurisdictions need to plan for it. Absent planning, maintenance tends to occur when the need for repair arises—typically a more costly arrangement leading to premature equipment failure.

RECOMMENDATION

Local jurisdictions should include preventive maintenance along with other maintenance projects in long- and short-term maintenance plans that are tied to capital improvement programs, capital budgets, reserved accounts, and operating budgets.

Active planning for preventive maintenance should occur at the same time as planning for other maintenance; it is needed both for the long-term (at least a three-year outlook) and the short-term (the upcoming year).[43] Long-term planning includes a long-range facility plan and a capital improvement program. Short-term planning includes annual work plans and annual budgets.

Develop a Long-Term Facility Plan

Long-term plans establish goals that guide maintenance activities and help allocate resources strategically.[44] The plans also provide common objectives for employees by defining goals for the jurisdiction toward which individual staff members strive.[45] They chart a future for a jurisdiction's facilities and help building managers identify those maintenance projects that best meet the overall needs of the jurisdiction. Long-term plans make building needs explicit to elected officials and the community at large.

- **Of local jurisdictions indicating they actively perform preventive maintenance, 53 percent of school districts (155 districts) and 26 percent of cities and counties (52 jurisdictions) reported that they had written, long-range plans for maintenance.**

Larger school districts, cities, and counties tended to have written, long-range plans more often than smaller ones. Among school districts indicating they actively perform preventive maintenance, 71 percent with large amounts of square footage had long-range plans, compared to 52 percent of districts with medium amounts of square footage and 35 percent with small amounts of square footage.[46] Similar trends were apparent when comparing school districts by size of student populations.[47]

---

[43] Cotts, *The Facility Management Handbook*, 58.

[44] Glen I. Earthman, *Planning Educational Facilities for the Next Century* (Reston, VA: ASBO International, 1992), 23.

[45] *Ibid.*, 18.

Long-range plans also varied with the population size of cities and counties.[48] Among cities actively performing preventive maintenance, 41 percent of those with populations above 8,000 had long-range plans; only 11 percent of those under 8,000 population did. Among counties actively performing preventive maintenance, 32 percent of larger counties reported having long-range plans compared to 24 percent of smaller counties.

A long-term plan sets directions for future maintenance.

Long-term planning can cover any number of years depending on local needs, although it typically covers a three- to five- to ten-year period.[49] A longer outlook may be preferable to accommodate longer-term needs, such as roof replacements which vary from 10 to 30 or more years depending upon the type of roof.

As a goal-setting document, a long-term plan takes a broader view of facilities than an annual plan. Although the contents of a long-term plan will differ from jurisdiction to jurisdiction, the plans typically contain five important elements:[50]

(1) A description of the jurisdiction, its agencies and how they are organized, and the community in which it is located.

(2) An explanation of the overall mission and purposes of the jurisdiction and how facilities fit into fulfilling those purposes.

(3) A description of the jurisdiction's clients (the intended recipients of its services) and how this population is expected to change in the future.

(4) An account of the facilities operated by the jurisdiction and appraisal of their adequacy for meeting overall goals. This element includes a building-by-building assessment of improvements listing expected years of completion; projects are ranked by need and based on the expected remaining life of building systems. Jurisdictions with deferred maintenance should include plans for reducing the backlog.[51]

---

[46] Based on square footage of all school district-owned building space, we divided districts into three groups: small districts with less than 143,356 square feet of space, medium districts with between 143,356 and 321,615 square feet, and large districts with 321,616 or more square feet.

[47] Based on student headcounts statewide, we divided school districts into three groups: smaller districts had 0 to 663 students, medium districts had 664 to 1,612 students, and larger districts had 1,613 or more students.

[48] We divided cities into two groups: large cities had populations of 8,000 or more and small cities had populations less than 8,000. We defined large counties as those with populations of 30,000 or more and small counties as less than 30,000.

[49] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 22.

[50] *Ibid.*, 22-23; ASBO International, *Principles of School Business Management*, 2d ed. (Reston, VA: ASBO International, 1995), secs. 18-4, 18-5; and Earthman, *Planning Educational Facilities for the Next Century*, 23-26.

[51] Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 43.

BEST COPY AVAILABLE

(5) An assessment of the financial resources required to fund desired improvements. Projections of operating and capital costs give policymakers information to anticipate upcoming financial needs. In cases of major improvements, it is prudent to include a range of project alternatives, instead of a single value, listing each option's estimated costs and level of service.[52] This planning becomes the basis for a capital improvement program (described below).

Although long term by nature, the plan requires annual review and updating.[53] Those involved in the planning should recalculate cost estimates based on updated condition levels and current costs of equipment and labor. Updating is also necessary because projections of deferred maintenance may decrease due to completed projects, or increase from ongoing deterioration. Plus, the general uncertainty involved with any long-range forecast requires building administration to revise costs and building information with its best professional estimates.[54]

Develop a Capital Improvement Program

All jurisdictions that own facilities need capital improvement programs.

Information in the long-term plan provides a base for a capital improvement program. Simply put, a capital improvement program is a schedule of capital improvements, listed in priority order, over a number of years (usually five or more).[55] The capital improvement program's time span typically coincides with the long-range plan. In contrast to the long-range plan, the capital improvement program is a set of proposed actions.[56] It proposes specific projects to meet the needs identified in the long-range plan. If the long-range plan offers a range of alternatives, the capital improvement program identifies a specific course of action the jurisdiction intends to take. Capital improvement programs typically include remodeling and new construction, as well as major maintenance projects.

All jurisdictions that own facilities should develop capital improvement programs to accurately prepare for the future needs and costs of their physical plant.[57] We found that:

- **55 percent of school districts (165 districts) responding to the survey reported developing a capital plan for their facility components that**

---

[52] U.S. ACIR and U.S. Army Corps of Engineers, *High Performance Public Works*, 32; and Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 24.

[53] Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 94; and ASBO International, *Principles of School Business Management*, sec. 18-5.

[54] U.S. ACIR and U.S. Army Corps of Engineers, *High Performance Public Works*, 32.

[55] Gregory Vaday, "Planning for Capital Improvements," *International City/County Management Association Management Information Service Reports* 25, no. 10 (October 1993): 1. Although capital projects typically are (1) more expensive physical improvements or purchases that (2) do not recur each year and (3) tend to last a long time, the definition of a "capital project" is not rigid. Jurisdictions may legitimately define capital expenses differently.

[56] Earthman, *Planning Educational Facilities for the Next Century*, 101.

[57] Vaday, "Planning for Capital Improvements," 1-3.

included provisions for preventive maintenance activities.[58] Of the cities and counties that actively perform preventive maintenance, 27 percent (52 cities and counties) said they consistently have capital improvement plans with provisions for preventive maintenance.

Another 30 percent of cities and counties (57 jurisdictions) actively performing preventive maintenance said they *sometimes* have capital improvement plans with provisions for preventive maintenance.

When estimating costs for the capital improvement program, building managers should base their estimates on building components' remaining useful life.[59] This is important because components that have been neglected will have an older "effective" age requiring earlier replacement than those that have been well maintained. Table 2.3 shows that 42 percent of school districts responding to the survey reported developing a capital plan with cost estimates based on components' remaining useful life.

Although capital programs typically cover five years, they should be updated annually.

Unless the capital improvement program's estimated costs are based on the best available data, its projections could substantially over or underestimate actual costs.[60] Therefore, it is necessary to use standard cost data when estimating project costs.

Officials that develop the capital program should update its cost estimates annually to account for inflation and changes that occur to the buildings.[61] As shown in Table 2.3, 71 percent of school district survey respondents reported they develop capital plans with annual updates.

Table 2.3: Elements of School Districts' Capital Plans, 1998-99

Practice	Percent of School Districts (*N*=301)
District develops a capital plan	84.7%
Capital needs are based on long-range plan for facility maintenance	77.1
Plan includes annual updates	71.1
Plan includes provisions for preventive maintenance projects	54.8
Cost estimates are based on remaining useful life of major components	41.5

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

---

[58] The 1995 Legislature repealed a statute that had required school districts to adopt capital expenditure facilities programs with a schedule of up to five years of work. The program covered repairs, restorations, and new construction. See *Minn. Stat.* (1994) §124.23.

[59] Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 53-60; and R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 314.

[60] Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 62.

[61] *Ibid.*, 60.

Establish a Reserved Account

Maintenance and planned replacements vary from year to year. Some years require larger expenditures for major projects, such as reroofing, tuckpointing brick exteriors, and replacing a boiler or cooling tower. Consequently, local jurisdictions should reserve an amount of money each year to provide funding for the renewal of building components.[62] Defined simply, reserved accounts spread out over many years the payments for replacing building components. According to the survey:

- **School districts were less likely than cities and counties to use reserved funds.**

Table 2.4 shows that 9 percent of school districts (24 districts) actively performing preventive maintenance reported relying consistently on reserved accounts to fund some preventive maintenance projects. Of the cities and counties that actively perform preventive maintenance, 23 percent of cities (30 cities) and 11 percent of counties (5 counties) indicated they rely consistently on reserved funds for this funding.

The school district percentage refers to reserved accounts other than the "operating capital" account. As explained in Chapter 3, school districts' operating capital revenues are in a reserved account within their general funds; state statutes restrict uses of operating capital but allow for purchasing textbooks and computers in addition to improving buildings.[63] Although a relatively low percentage of counties reported using reserved funds, 47 percent of those performing preventive maintenance said they consistently levy taxes for a "county building fund," used solely to acquire, maintain, and repair buildings.

Table 2.4: Use of Reserved Funds for Preventive Maintenance, 1999[a]

	Use Consistently	Use Sometimes	Use Rarely, If Ever
School districts[b] (*N*=262)	9.2%	24.8%	66.0%[c]
Cities (*N*=133)	22.6	42.1	35.3
Counties[d] (*N*=46)	10.9	45.7	43.5

[a] Includes only local jurisdictions indicating they actively performed preventive maintenance.

[b] The reserved accounts are those other than school districts' "operating capital" reserves.

[c] Responses include districts indicating they did not fund preventive maintenance.

[d] 47 percent of counties reported consistently levying taxes for a "county building fund" with proceeds used for constructing and maintaining county buildings.

---

[62] *Ibid.*, 60-61; R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 309-316; and Kaiser, *The Facilities Audit*, 46-49.

[63] *Minn. Stat.* §126C.10, subd. 14.

Few local jurisdictions consistently use reserved funds for budgeting major maintenance projects.

Establishing reserved funds requires a jurisdiction's elected officials to place high priority on renewing building components when setting budgets. With reserved funds, jurisdictions affirm the importance of an ongoing investment in preserving their physical plant. Planning adequate reserved funds depends on needs identified from building condition assessments, calculations of components' useful remaining life, and accurate estimates of project costs.

Develop an Annual Work Plan

An annual work plan and budget should flow from the strategic long-term goals and objectives developed for a jurisdiction's buildings.[64] According to the survey,

- **Two-thirds of school districts (191 districts) that actively perform preventive maintenance have annual building maintenance plans to identify upcoming preventive maintenance projects.[65]**

Some annual plans are more complete than others, however. Table 2.5 depicts the elements in school districts' annual building maintenance plans.

The work plan should list all expected maintenance projects for the year: preventive maintenance, general maintenance, major and minor repairs, custodial operations, alterations, and construction.[66] It should also include projects needed to reduce backlogs of deferred maintenance.[67] To be realistic, the work plan should be developed in conjunction with annual budgets (discussed below).

Table 2.5: Elements of Annual Building Maintenance Plans in School Districts, 1998-99

Item	Percent of School Districts[a] (*N*=287)
Had annual building maintenance plan to identify preventive maintenance expected in coming year	66.6%
List of projects expected to be completed in the coming year	61.0
Cost estimates for capital needs	56.4
Cost estimates for operations	46.0
Mid-year review and update of the plan	26.1
Plans to reduce backlog of deferred maintenance	24.4
Analysis of labor needs, including for unscheduled repairs	18.8

[a] Includes only school districts indicating they actively performed preventive maintenance.

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

---

64 Cotts, *The Facility Management Handbook*, 64; and Earthman, *Planning Educational Facilities for the Next Century*, 21-22.

65 We did not collect similar data from cities and counties.

66 Cotts, *The Facility Management Handbook*, 60-61.

67 *Ibid.*, 60; Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 39; and U.S. ACIR and U.S. Army Corps of Engineers, *High Performance Public Works*, 32.

As part of the annual plan, building managers should determine what labor is needed for the projects. This means analyzing how many staff hours and which trade skills will be required to perform the planned maintenance tasks.[68] Managers should also assess whether the projects require engineering expertise or other special skills or equipment. Because virtually all buildings require unscheduled work activities sometime during a year, due to equipment breakdowns or other unforeseen events, the work plan should include time for unplanned projects.[69]

During the year, building managers should review and update the annual work plan.[70] Changing conditions and needs require adjusting the annual plan to reflect tasks that were added and others that were dropped over the year.

Link Work Plan to Annual Budgets

The annual work plan should link directly to the yearly maintenance budgets.[71] Projects in the work plan transform from ideas into reality only when they are included in operating or capital budgets. In the budget, building managers balance maintenance needs against available funding.

The annual budget shows for the coming year what money is needed for each project in the annual work plan, including projects intended to reduce maintenance backlogs.[72] Budget development requires preparing cost estimates for annual *operations*, such as personnel and supplies costs, as well as for *capital* costs, such as making major repairs. Each year's capital budget should flow from the longer-range capital improvement program described earlier.

The amount of spending needed for facility maintenance depends on the costs of buildings' identified needs, the extent of deferred maintenance, and the planned period over which the jurisdiction hopes to reduce building deficiencies.[73] Higher spending any given year will bring conditions to their desired level faster; lower spending lengthens the time.

A work plan becomes reality only when linked to operating and capital budgets.

No single rate of maintenance spending applies to all buildings. Based on a study of maintenance needs, however, the American Public Works Association (APWA) and National Research Council recommended calculating the adequacy of maintenance funding as a percentage of buildings' current replacement value.[74]

---

[68] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 70-76; and Cotts, *The Facility Management Handbook*, 60, 68.

[69] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 72.

[70] Cotts, *The Facility Management Handbook*, 65.

[71] *Ibid.*, 58-59.

[72] *Ibid.*, 60-61.

[73] Kaiser, *The Facilities Audit*, 45.

[74] APWA and National Research Council, *Committing to the Cost of Ownership*, 10. Other references cite the need for a minimum 2 percent of current replacement value: see Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 73-75, and Kaiser, *The Facilities Audit*, 46.

The rule of thumb states that this rate should average between 2 and 4 percent of current replacement value over several years.[75] The 2 to 4 percent guideline is intended to cover maintenance and repair; it does not include expenditures needed to reduce a backlog of deferred maintenance.

The APWA and National Research Council acknowledged that the actual expenditures for building maintenance in a jurisdiction will vary according to unique facility conditions, building age, availability of funds, and usage of the building. They viewed an average of 2 to 4 percent, however, as sufficient to maintain buildings and systems in functioning condition without deferring projects. Smaller jurisdictions may not require that amount each year and the report recommended that they use the average 2 to 4 percent guideline over a longer period of 5 to 10 years.

Few school districts, cities, or counties indicated in the survey that they use this guideline.[76] According to the survey,

- **Only 2 percent of school districts (7 districts) responding to the survey reported that they budget a percentage of their buildings' current replacement value for purposes of preventive maintenance. Seventeen percent of cities and counties (33 jurisdictions) actively performing preventive maintenance consistently use this practice.**

Some local jurisdictions budget for certain preventive maintenance by setting aside an amount of money based on the annual depreciation of their building systems and equipment.[77] Of those jurisdictions that actively use preventive maintenance for at least some of their building components, approximately 13 percent of school districts, cities, and counties reported they consistently use the depreciation budgeting practice.

Some local officials object to the concept of depreciating a public building under certain circumstances. The objection stems from the practice of using taxpayer dollars to pay the bonds sold to purchase a building, while at the same time setting

---

[75] *Ibid.*, 10. Current replacement value is the amount needed to duplicate facilities. For state buildings, *Minn. Stat.* §16A.11, subd. 6 incorporates a similar guideline. State operating budgets proposed by the governor are to include amounts necessary to maintain state buildings. The commissioner of finance is to set budget guidelines for maintenance appropriations. The amount to be budgeted is 2 percent of the cost of the buildings, adjusted up or down depending on the building's age and condition, unless otherwise provided by the finance commissioner.

[76] Expenditure data reported by school districts to the Department of Children, Families, and Learning are insufficiently precise to determine how many districts' building expenditures fall within the guideline.

[77] In the near future, compliance with generally accepted accounting principles will require depreciation of capital assets. Recent changes to standards for governmental accounting require local jurisdictions to report all capital assets (such as buildings and building improvements) and infrastructure (such as roads and water systems), as well as depreciation expenses for these assets. Depreciation of infrastructure is not required if the jurisdiction uses an "asset management system" to preserve its capital assets. See: Governmental Accounting Standards Board (GASB), *Statement No. 34, Basic Financial Statements—and Management's Discussion and Analysis—for State and Local Governments* (Norwalk, CT: GASB, 1999), 10-13.

BEST COPY AVAILABLE

aside revenues from the same taxpayers for depreciation. In this circumstance, current residents pay twice for components: once with the initial purchase and a second time through tax dollars allocated to depreciation.

Examples Related to Strategically Planning and Funding Preventive Maintenance

Anoka-Hennepin School District's Planning for Maintenance

In the Anoka-Hennepin School District, buildings and grounds department administrators work with building supervisors in each school to develop long-term capital improvement plans. By dividing responsibilities between individual schools and the districtwide buildings and grounds department, the school district is able to oversee more than 900 projects per year, while allowing flexibility in meeting individual building needs.

To determine the district's capital needs, building supervisors annually assess their buildings' conditions and submit plans recommending project priorities to the buildings and grounds department. For smaller projects, building supervisors and school principals work together to set project priorities, develop site-based plans, and develop budgets. For larger projects, such as tuckpointing, or those with districtwide implications, such as meeting fire-safety regulations, building supervisors work with department administrators on a ten-year capital plan. The school district hires consultants to evaluate and critique proposed major projects and estimate costs.

In Anoka-Hennepin School District, maintenance planning and funding are divided between the districtwide office and individual school buildings.

The buildings and grounds department manages the larger and districtwide capital repairs, as well as health and safety projects. For districtwide projects, such as roof replacements, the department uses a rotating schedule for school buildings. For some buildings, the department schedules projects for even-numbered years, while for others, the department schedules projects during odd-numbered years. This schedule allows each school a year to plan ahead and work with architects and staff to identify specific needs. By having one department manage all large projects, the school district achieves economies when bidding projects.

The district also divides some fiscal responsibility. The buildings and grounds department keeps a portion of its total annual budget, and the school district allocates equitable portions of the remaining amount to the schools. The buildings and grounds department determines the amounts according to historical needs and building conditions of each school. To aid fiscal planning for site-based projects, the department distributes a ten-year schedule outlining projected annual funding for each school building. Knowing estimated available funds ahead of time helps building supervisors set project priorities.

While individual schools make decisions about how to spend their funds, the department monitors their expenditures and fund balances. If a school does not spend its total amount, it may carry over the funds for the following year. The funding arrangements are not rigid; site-based money occasionally funds larger projects the department typically covers, such as boiler replacements. At the same time, the department funds and manages certain projects, such as those affecting life safety.

School officials use these planning and funding methods to keep decision making closer to each school and allow more flexibility in applying resources. The methods also place accountability at the school level for some maintenance and repair of school buildings. Although building supervisors manage their own buildings' needs, the department oversees site-based activities to ensure buildings are properly maintained and the district is preserving taxpayers' investment.

School officials emphasize that Alternative Facilities Bonding and Levy Revenue and Health and Safety Revenue help the district fund its deferred maintenance and large capital improvements. The district also uses a computerized maintenance management system to schedule and manage the large volume of projects. Small jurisdictions with few buildings may not need to divide planning and funding responsibilities between a district office and individual building sites.

For more information contact:
Louis Klingelhoets
Anoka-Hennepin School District Director of Buildings and Grounds
763/506-1228

Detroit Lakes School District's Planning for Maintenance

In the Detroit Lakes School District, the business manager and supervisor of operations prepares long-range plans with a ten-year outlook for capital needs of district buildings. These long-term plans describe the condition of building components and estimate costs to repair or replace them. School district officials update the plans yearly and base them on annual assessments of school building conditions; building personnel conduct some of the assessments, but for most condition assessments the district relies on outside professionals with expertise in particular building components, such as roofs, HVAC, and bituminous surfaces.

In addition to the long-range planning that focuses on capital needs, the supervisor of operations develops a yearly maintenance plan and budget. The plan includes large and small maintenance needs solicited from building supervisors as well as from school district staff who occupy the buildings. Forms are available for all staff to request maintenance projects for the building space with which they are most familiar. Principals funnel the requests to the superintendent, business manager, and supervisor of operations, who collectively assign priorities from among the suggestions. Projects related to health and safety receive top priority.

To make funding recommendations, the school district relies on a building committee, consisting of three school board members, the superintendent, the district business manager, and the supervisor of operations. The building committee examines staff recommendations, analyzes what maintenance can be done within available resources, sets priorities among projects, and ultimately recommends maintenance budgets to the school board. In instances where funding constraints require setting projects aside for a year, the requests are reconsidered along with new proposals during the next annual budget cycle.

A buildings committee in Detroit Lakes School District reviews needs and recommends maintenance budgets.

To help determine when to budget for replacing equipment, the operations supervisor keeps a file of major equipment, such as floor sanders or maintenance vehicles. The file tracks serial numbers and service records for equipment and allows the supervisor to estimate equipment life spans. For instance, with information from the file, the supervisor knows he will need to budget for the replacement of a 1974 lawn mower that was experiencing problems and had already had its motor overhauled some years ago.

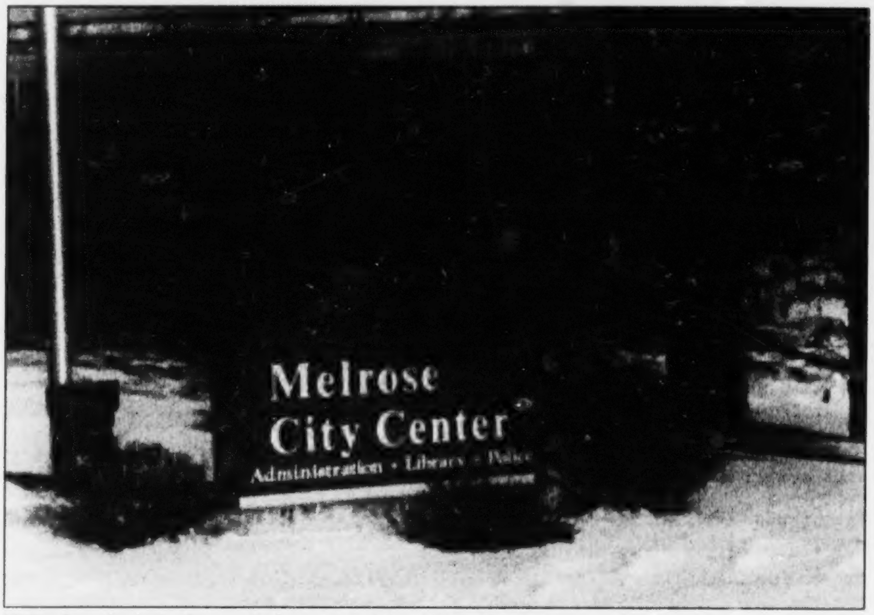
Building-committee members consider detailed information on building needs and become acquainted with specific projects, such as problems with HVAC units on schools' roofs. The building committee informs the full school board about current and long-term building needs. It wants school board members to have enough information that they are not surprised when the time arrives for funding major projects, but not so much as to overwhelm them with day-to-day operations.

Besides general fund dollars and Health and Safety Revenue, the district has used proceeds from two bond issues in the past decade to fund building maintenance and replace components, among other expenditures. The operations supervisor believes the district's planning process has been instrumental in convincing school board members to appropriate the money needed to keep up the condition of district buildings. The plans provide staff with a tool for preparing to meet building needs and keep the school board informed about the needs. Despite adequate planning, the amount of available money is less than the current identified building needs; as student enrollment continues to decline in the Detroit Lakes School District, reductions in revenues could further reduce maintenance spending.

For more information contact:
Bradley Green
Detroit Lakes School Supervisor of Operations
218/847-9271

City of Melrose's Planning and Funding of Maintenance

Melrose provides electricity, water, and wastewater services to its residents and funds the services as "enterprise funds," for which it charges fees to cover costs. With each budgeting cycle, the city identifies for the coming year all expected building expenses, both for operating and capital purposes and direct and indirect costs, and factors these expenses into its utility rates. All city buildings, including the Melrose City Center which houses the police department and city administrative offices, are included in the estimate of maintenance expenses. Utility fees paid by residents, therefore, reflect the costs of producing power, water, and sewer services, including the cost of maintaining all public buildings.



Utility fees include the costs for maintaining city buildings.

Funding city services in this way requires substantial advance planning. The city sets aside funds yearly for capital costs of necessary improvements to its buildings. To do this, it uses the annual depreciation of equipment to reserve money needed to eventually replace the equipment. As an example, city personnel estimated a need to replace a rooftop compressor in 20 years. They based the estimate on their own experience with the compressor and on equipment manufacturers' projections. Using price estimates from local suppliers, the city estimated the unit's cost and adjusted it to account for future inflation. For each of the next 20 years, the city will determine an amount equivalent to approximately 1/20th of the projected purchase price and include this amount in setting utility rates. At the end of 20 years, it expects to have sufficient revenues in its reserved capital fund to replace the compressor. The public works director and city administrator follow this process in depreciating all major building components.

Melrose relies on a five-year capital improvement plan to record capital needs and equipment required for city services. It updates the plan yearly, adjusting its line items to account for work already completed and to add newly identified needs. The city council and a utilities commission, which the council appoints, review and approve capital projects each year.

Besides capital costs, the city builds the cost of maintenance and operations into its utility rates. Money allocated for maintaining and operating Melrose's public buildings, however, does not accumulate from year to year as do the amounts for capital projects, which are based on depreciation of building components and equipment. If annual maintenance needs turn out to be less than projected, the remaining revenues go into a reserve fund. When emergencies or other unanticipated needs arise, the city taps this reserve fund.

The city's process of including facility maintenance costs in utility rates is not available to school districts and counties, which typically do not charge rates for their services; further, not all local jurisdictions depreciate building components. Nonetheless, the process of identifying building needs, estimating costs for maintaining or replacing building components, and using a means to accumulate revenues for component renewal is not limited to jurisdictions that charge rates for utilities.

For more information contact:
Rose Ann Inderrieden
Melrose City Administrator
320/256-4278 or

Don Salzmann
Melrose Public Works Director
320/256-4666

Wabasha-Kellogg School District's Planning and Reserved Fund

Wabasha-Kellogg school officials maintain a five-year capital plan and a reserved account for building needs. The capital plan prepares the district for future major expenditures. By setting aside money from its operating capital account into a separate account, the district reserves financial resources to complete its planned building system repairs and replacements.

The Wabasha-Kellogg School District sets aside money exclusively for capital maintenance projects.

Throughout the year, the buildings and grounds supervisor compiles information about building and equipment deficiencies and their estimated costs. For larger projects, the district hires consultants to verify the remaining useful life of building components and estimate project costs. School officials revise the capital plan in light of updated information about costs or urgent repairs.

Each year the school district sets aside money from its operating capital fund into a reserved account to prepare financially for future capital projects. The annual amounts are determined according to the schedule of upcoming projects, such as roof repairs, in the capital plan. If actual expenditures exceed estimated costs, school officials adjust the amount set aside to ensure adequate funding for future projects. School officials have consistently funded this account, in spite of declining student enrollment and reduced state funding.

Wabasha-Kellogg school officials emphasize that capital planning is critical to effectively manage their financial resources and avoid unexpected building system failures. For similar financial planning, jurisdictions should periodically assess building conditions and maintain accurate records of maintenance and repair expenses. To fund a reserved account, jurisdictions must establish budget priorities that set aside money for their buildings.

For more information contact:
Larry Kronebusch
Wabasha-Kellogg School District Buildings and Grounds Supervisor
651/565-3559 ext. 203

Westbrook School District's Funding of Maintenance

The alternative source of money in Westbrook School District eases competition for building maintenance resources.

The Westbrook School District maintains approximately 92,000 square feet of building space (among the smaller one-third of square footages for districts in the state).[78] In the early 1990s, school officials established an Education Foundation to raise funds for the district. Established initially to benefit student scholarships, the foundation expanded eligible expenditures to include instructional equipment and classroom materials. By having this alternative pool of financial resources for certain expenditures, the district is able to reserve more of its general fund and operating capital revenue for building maintenance.

Comprised of school officials and community members, the nonprofit organization has raised as much as $30,000 in a single year. Foundation members place alumni and community contributions in a reserved account. Rather than use operating capital revenue, school officials occasionally use the reserved donations for items such as textbooks and computer software.

School officials believe the district benefits from the Education Foundation's additional funds because they somewhat ease internal competition for limited general fund monies. The costs associated with running the foundation include state filing fees for nonprofit organizations, time spent in volunteer hours for fundraising efforts and secretarial services, and several hundred dollars in annual mailing expenses.

For more information contact:
Stephen Kjorness
Westbrook School District Superintendent
507/859-2141

Other jurisdictions we visited demonstrated best practices for planning or funding preventive maintenance. Some are listed here along with contact names.

City of Brooklyn Park, Steve Lawrence, Central Services Superintendent, 763/493-8028;
Duluth School District, Kerry Leider, Director, Facilities and Risk Management, 218/723-4118;

---

[78] The Westbrook School District is academically paired with the Walnut Grove School District; the districts cooperate in providing educational services for 5th through 12th grade students.

Fridley School District, Duane Knealing, Director of Maintenance and Transportation, 763/502-5008
Worthington School District, David Skog, Director of Management Services, 507/372-2172.

4. Structure a Framework for Operating a Preventive Maintenance Program

By definition, preventive maintenance means inspecting, adjusting, lubricating, testing, and replacing on a regular, ongoing basis. To do this effectively, building managers need a framework that supports the preventive maintenance program.

RECOMMENDATION

Building managers should (1) coordinate preventive maintenance with other maintenance projects, (2) prepare a checklist of preventive maintenance tasks, (3) schedule a timeline for the tasks, (4) prepare procedures for managing the program, and (5) include preventive maintenance among activities for controlling the quality of air inside buildings.

Coordinate the Program with Other Maintenance

In most jurisdictions, preventive maintenance projects will be performed among many other maintenance requests. Therefore, the overall maintenance program requires coordination to ensure work is assigned to the appropriate personnel and performed when it is supposed to be.

This means designating responsibility for coordination with a specific individual or department.[79] A coordinator should be responsible for synchronizing all maintenance jobs—including preventive, general, and emergency maintenance. This lodges accountability for managing maintenance with specific staff. It also helps ensure that maintenance projects of one type do not interfere with others, such as repainting a wall that is soon to be modified as part of a remodeling project.

Develop Checklists of Tasks and Their Frequency

Including every piece of every building system in a preventive maintenance program is unnecessary and prohibitively expensive.[80] The time involved with such an effort would be enormous and the outcomes unlikely to justify the expense. Building managers should exclude from a preventive maintenance program equipment that is inexpensive and easy to replace.[81]

---

[79] Cotts, *The Facility Management Handbook*, 190; and Rex O. Dillow, *Facilities Management: A Manual for Plant Administration* (Washington D.C.: The Association of Physical Plant Administrators of Universities and Colleges, 1984), III-109.

[80] R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 254.

Equipment that is inexpensively and easily replaced does not need preventive maintenance.

Consequently, building managers must determine in advance which equipment is critical to the continued safe operation of the building, carries high repair or replacement costs, or is difficult to purchase "off the shelf." Equipment of this type should be part of the preventive maintenance program.

After deciding which items to include in the program, building managers should develop a checklist of preventive maintenance tasks.[82] The checklist should specify for each type of equipment what inspections, calibrations, lubrications, or replacements are needed.[83] Using a specific checklist with detailed activities helps ensure that needed servicing is not inadvertently neglected. As shown in Table 2.6,

- **Of jurisdictions responding to the survey, nearly 38 percent of school districts, and 18 percent of cities and counties, reported that they prepare checklists of preventive maintenance tasks for most building components.**

Table 2.6: Preventive Maintenance Practices Used by Local Governments, 1999

	For Most Building Components		For Some Building Components		Do Not Use Practice	
Practice	School Districts	Cities and Counties	School Districts	Cities and Counties	School Districts	Cities and Counties
Prepare checklists of maintenance tasks for employees (*N*=304 schools and 289 cities and counties)	37.8%	17.6%	36.2%	32.5%	26.0%	49.8%
Schedule preventive maintenance tasks according to manufacturers' recommendations or set intervals (*N*=306 schools and 292 cities and counties)	52.3	32.2	38.6	31.8	9.2	36.0
Keep comprehensive records of preventive maintenance activities and costs (*N*=306 schools and 287 cities and counties)	20.6	16.4	43.5	34.1	35.9	49.5

SOURCE: Office of the Legislative Auditor's surveys of school districts and cities and counties, 1999.

---

[81] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 31.

[82] *Ibid.*, 32; R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 254-255; ASBO International, *School Facilities Maintenance and Operations Manual*, 31; and Dillow, *Facilities Management*, 111-117.

[83] R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 255.

BEST COPY AVAILABLE

The checklist should also indicate the frequency of the preventive maintenance task. This timetable for servicing equipment should specify whether the task is to be performed weekly, monthly, annually, or at some other interval.[84]

To produce the checklist, building managers should rely to the extent possible on recommendations by manufacturers of the specific equipment.[85] Manufacturers' guidance will indicate which preventive maintenance tasks are necessary and their frequency. This is especially important because some manufacturers' warranties remain in effect only if owners conduct the required preventive maintenance.

A checklist should specify preventive maintenance tasks and their frequency.

Realistically, however, manufacturers' recommendations are not always available. Other sources are also helpful for the checklist, including records of the equipment's own maintenance history, employees' experience, preventive maintenance guides prepared by industry groups and trade associations, and building codes.[86]

Schedule Timelines to Perform Tasks

As part of the annual work plan, building managers should prepare one-year schedules of the preventive maintenance tasks to be performed.[87] The timelines should depend on equipment manufacturers' recommendations or other predetermined intervals. Table 2.6 shows that:

- **Of survey respondents, 52 percent of school districts, and 32 percent of cities and counties, reported scheduling preventive maintenance tasks according to manufacturers' standards or other set intervals for most of their building components.**

The schedule should detail when the tasks are to be completed and estimate the amount of time needed for each activity. For each week in the year, it should list all activities that need to be completed.

When setting the schedule, building managers should time projects to minimize disruptions to building users and take advantage of equipment down times. For instance, jurisdictions should conduct preventive maintenance on cooling equipment while it is shutdown in the winter.[88] Similarly, consolidating multiple tasks within a single building or scheduling similar types of work together, to the extent possible, helps maximize efficiency.[89]

---

[84] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 83.

[85] ASBO International, *School Facilities Maintenance and Operations Manual*, 31; and R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 255.

[86] R. S. Means Company, Inc., *Cost Planning & Estimating for Facilities Maintenance*, 255. For example, two publications with suggested preventive maintenance tasks and their frequencies are: (1) *How to Design and Manage Your Preventive Maintenance Program* published by the Building Owners and Managers Association International and (2) *Facilities Maintenance & Repair Cost Data* published by R. S. Means Company, Inc.

[87] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 32, 34; and Kaiser, *The Facilities Manager's Reference*, 98-99.

[88] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 34.

[89] Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 43.

Adopt Written Procedures to Manage the Program

To adequately manage a preventive maintenance program, procedures are needed to guide how the program is planned and budgeted and how the actual work will be coordinated.[90] This requires a written procedures manual. Following a procedures manual brings consistency to the program. It also offers some control over activities that might otherwise be done haphazardly or not at all. In answer to the survey, 28 percent of school districts, and 5 percent of cities and counties, reported they developed guidelines to plan or budget preventive maintenance for most building components.

Written procedures will vary by jurisdiction, but should typically address certain elements. Procedures should establish who is responsible for controlling work orders and administering staff. To aid budget preparation, procedures should specify a cost-accounting system as well as the format for reporting the budget.

For managing maintenance projects, procedures should define responsibilities expected of each trade represented on staff. The procedures should make explicit what work is expected from each trade and help coordinate multiple trades people who may be involved in a single project. Written procedures also help employees understand what is expected of them.

Jurisdictions that employ outside help to perform maintenance should follow procedures on when to use contractors as well as how to bid for them and supervise them while on the job.[91] The procedures should specify the services for which contractors will be used. For instance, services that are performed infrequently or that require special equipment or expertise, such as roof repairs, are often good candidates for contracting.[92]

Good contracts should specify how to measure successful completion of the job.

Building managers should have procedures for good contracts. Historical practice shows that effective contracts explicitly state (1) the quality and quantity of the needed service, (2) specific measures to determine service quality, and (3) steps to take if service is inadequate.[93] Contracts that lack criteria for defining satisfactory work prevent local jurisdictions from verifying proper completion of the job.

Written procedures are needed to control the inventories of a maintenance department's materials and equipment. They should designate who is responsible for monitoring and requisitioning parts and equipment to ensure adequate supplies of materials are on hand when needed without overburdening available storage space. Forty-one percent of school districts, and 18 percent of cities and counties, reported that they maintain a supply of materials and parts to allow timely maintenance for most building components.

---

[90] Kaiser, *The Facilities Manager's Reference*, 99.

[91] APWA and National Research Council, *Committing to the Cost of Ownership*, 19.

[92] Hilary Green and Rita E. Knorr, *Contracting Maintenance Services* (Chicago: APWA, 1990), 14.

[93] *Ibid.*, 4.

Building managers should also have procedures on how to manage emergency situations, should they occur. With formal procedures designed in advance, staff will know their responsibilities and appropriate roles when emergencies, such as storms or electrical failures, occur. If staff have no plan to react, a minor emergency could quickly escalate into a major one.

Follow Indoor Air Quality Program

Maintaining the quality of indoor air has become increasingly important due to the large amount of time people tend to spend indoors and because of the environmental threats that poor air can pose to public health, according to the U.S. Environmental Protection Agency.[94] Many factors, such as building construction, affect the condition of inside air. One of the important factors is how management operates and maintains buildings, particularly the HVAC systems.[95] Some buildings' HVAC systems are designed to maximize energy savings instead of providing adequate outside air for ventilation; inadequate ventilation can contribute to indoor air problems.

Preventive maintenance helps control the quality of indoor air.

Water damage to building materials or furnishings is another contributing factor. It is a prime source of microbial contamination that affects indoor air, posing health risks.[96]

Certain preventive maintenance can help meet recommended ventilation rates and manage the quality of inside air. Periodic cleaning of ventilating ducts, air plenums, cooling coils, and condensate pans minimizes the opportunity for the growth of microorganisms that would otherwise disseminate through ventilation systems.[97] In addition, inspecting and cleaning other HVAC components, such as outdoor-air intakes, air filters, and fan belts, can make the HVAC operate more efficiently while providing good indoor air quality.[98] Periodically testing and balancing HVAC systems keeps them operating in line with design specifications. Other recommended actions include planning building operations and maintenance in ways to prevent indoor air problems, such as managing airborne particulates from construction activities, and training employees on issues related to indoor air quality.[99]

---

[94] U.S. Environmental Protection Agency (EPA), *Building Air Quality Action Plan* (Washington D.C.: U.S. Government Printing Office, 1998), 2.

[95] American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE), *ASHRAE Standard 62-1989 Ventilation for Acceptable Indoor Air Quality* (Atlanta: ASHRAE, 1989), 7.

[96] University of Minnesota Department of Environmental Health and Safety, "Managing Water Infiltration into Buildings"; http://www.dehs.umn.edu.remanagi.html; accessed December 2, 1999.

[97] ASHRAE, *Ventilation for Acceptable Indoor Air Quality*, 5-6.

[98] International City/County Management Association, "Efficient Indoor Environments," *Indoor Air Quarterly* (Summer 1999): 6; and U.S. EPA and National Institute for Occupational Safety and Health, *Building Air Quality: A Guide for Building Owners and Facility Managers* (Washington D.C.: U.S. Government Printing Office, December 1991), 34-36. Some inspections may require contracts with specialists who have expertise in inspecting for indoor air quality.

[99] The Minnesota departments of Administration and Employee Relations jointly published a training manual on indoor air quality. See: Department of Administration and Department of Employee Relations, *Guidelines for Managing Indoor Air Quality* (St. Paul, 1996).

Together with other federal agencies, the Environmental Protection Agency prepared a list of steps that building owners may take to reduce the risks of poor indoor air.[100] In addition, the agency provides information specific to schools' air quality issues and management practices.[101]

We found that,

- **Of survey respondents, 89 percent of school districts reported having an indoor air quality program.[102]**

Completeness of school districts' indoor air quality programs varied, as shown by Table 2.7. Of school districts responding to the survey, 62 percent had indoor air quality plans for operating or maintaining their facilities. Fifty-six percent reported having procedures in place to manage activities, such as painting projects or pest control, that could affect air quality. Nearly 73 percent reported having procedures for responding to complaints about indoor air quality.

The completeness of school districts' indoor air quality programs varied.

Table 2.7: School Districts' Indoor Air Quality (IAQ) Programs, 1998-99

Districts have:	Percent of School Districts (*N*=303)
An indoor air quality program	89.1%
A person designated as IAQ coordinator	78.9
Procedures for responding to IAQ complaints	72.9
Used prepared materials, such as "Tools for Schools," to develop program	67.3
An IAQ assessment with an annual review to identify problems	66.3
An IAQ plan for facility operations and maintenance	61.7
Procedures for managing activities, such as painting or pest control, that could harm air quality	56.4
IAQ training for staff, or information for contractors, whose functions could affect indoor air	51.8
School board review of IAQ program status and needs	36.6

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

Examples Related to Operating a Preventive Maintenance Program

Anoka-Hennepin School District's Preventive Maintenance Procedures

With yearly schedules of tasks and maintenance procedures manuals, the Anoka-Hennepin School District Buildings and Grounds Department efficiently manages preventive maintenance for the district's buildings. Its practices guide workers' activities, keep systems operating efficiently, and increase job safety.

---

[100] U.S. EPA, *Building Air Quality*, 13-106.

[101] U.S. EPA, *Indoor Air Quality Tools for Schools* (Washington D.C.: U.S. Government Printing Office, 1998); http://www.epa.gov/iaq/schools; accessed December 2, 1999.

[102] We did not collect similar data from cities and counties.

The department keeps yearly schedules of preventive maintenance tasks for building components. Each month, the department distributes lists of tasks to building supervisors, along with timelines for completing the tasks. For each task, the lists identify the location and type of building components and summarize the needed preventive maintenance. To develop the schedules and lists, the department relied on manufacturers' guidelines, warranty requirements, and employees' technical expertise. When timelines or tasks appear insufficient to properly maintain building systems, maintenance workers note deficiencies and forward the information to the department to modify the schedule. To verify preventive maintenance is performed correctly, department supervisors and building supervisors periodically tour buildings together.

To help maintenance workers perform proper preventive maintenance consistently, the department developed manuals that outline procedures for types of components. For instance, the manual describes step-by-step procedures for servicing boilers, including reviewing OSHA regulations, obtaining a confined-space permit, "locking-out" energy sources for the boiler system, and preparing the boiler for maintenance. The manuals provide workers with on-site references, enhance safety, and reduce inconsistencies that could otherwise occur with staff turnover.

In Anoka-Hennepin School District, emergency procedures determine who will assume responsibilities in the face of a building system failure.

In the event of a system failure or emergency, such as a power outage, the district follows written procedures to manage the incident. Designated individuals are responsible for specific tasks, such as notifying power companies, dispatching repair personnel, informing building occupants, and shutting down energy sources to prevent further damage to related systems. School officials periodically review emergency procedures during districtwide staff meetings so that administrators and maintenance personnel understand their roles.

Anoka-Hennepin school officials believe their strategies for managing preventive maintenance keep employees focused on needed maintenance. Since first implementing the preventive maintenance program in 1976, school officials suggest it has produced savings in time, money, labor, and supplies by extending the useful life of building components. Although the original goal of the program was in part to increase energy efficiency, the director of buildings and grounds believes the program has also reduced system failures and emergencies arising from lack of maintenance. Developing procedures manuals can require substantial time; Anoka-Hennepin school officials estimate one individual spent several weeks developing their own. The district uses its computerized maintenance management system to help prepare yearly maintenance schedules.

For more information contact:

Louis Klingelhoets
Anoka-Hennepin School District Director of Buildings and Grounds
763/506-1228

Detroit Lakes School District's Preventive Maintenance and Inspections

Every month, head custodians in each Detroit Lakes school building receive a list of monthly maintenance and custodial duties from the operations supervisor. The lists include items such as checking belts, changing filters, and activities for general cleanliness.

Head custodians review assignments with each shift of workers assigned to their buildings. They use clipboards located in the head custodian rooms to describe each worker's duties as well as events coming up that will require their services. The clipboards make explicit what work is needed and who is to perform it; they also allow head custodians to follow-up and evaluate the work as it is completed.

A clipboard system specifies maintenance tasks for each worker.

Head custodians inspect buildings monthly and rate the condition of classrooms, corridors, and other building areas with a "poor-fair-good-excellent" scale. Besides rating individual components within each area, such as the rails, walls, steps, and landings within stairwells, custodians write comments if additional action is required. Inspection forms verify that needed work was completed and provide the operations supervisor with records of conditions for all district buildings.

In addition to the monthly duties, the supervisor of operations directs less frequent preventive maintenance tasks. For instance, school district workers and contractors conduct ongoing maintenance of the HVAC system, including checking the dampers and oil levels, cleaning coils, changing filters, adding Freon (in the spring), and testing operation of the motors.

To help monitor building operations, the school district installed a computerized control system in some district buildings to oversee HVAC conditions. The system offers real-time readouts of conditions such as air temperatures and boiler operations. When mechanical problems occur, employees can pinpoint the problem from data on the computer screen. This saves time and increases the efficiency of building operations. For example, workers can monitor problems and make certain adjustments from the computer instead of having to go onto the roof to check air-handling units.

Maintenance workers in Detroit Lakes School District use color-coded blueprints of complex electrical and mechanical systems.

The district's operations department keeps in each school the blueprints and as-built drawings of the building's mechanical and electrical systems. Some blueprints are color coded to quickly and easily show the physical connections between different elements in the complex systems. Workers use the drawings to identify the location of building-system problems and help assess possible consequences for other elements in the system.

The combination of preventive maintenance and building monitoring helps school district building systems operate smoothly and with little interruption of daily activities. Coordinating the maintenance work and ensuring its completion requires advance planning and recognition that the time for these tasks is a good investment. Getting the most out of the computerized control system requires training for employees. Further, because the computerized system's up-front costs were about $150,000, the school district would not have been able to afford it without using bond proceeds.

For more information contact:
Bradley Green
Detroit Lakes School District Supervisor of Operations
218/847-9271

Fridley School District's Preventive Maintenance

In the Fridley School District, the maintenance director oversees preventive maintenance using schedules of maintenance tasks for each school's building components. He keeps a written list of HVAC and plumbing equipment and relies on maintenance employees and contractors for ongoing inspections.

Every quarter, the maintenance director sends a schedule of preventive maintenance tasks to the head custodian in each building. The schedule contains, for example, all HVAC equipment, its location by room in the building, and needed maintenance such as changing filters, lubricating moving parts, or cleaning coils. Workers indicate the date they complete the maintenance and note problems or other information in a comments section on the schedule. The system ensures that employees complete maintenance on a scheduled basis. It also provides a written maintenance history for the equipment.

The maintenance director also keeps an inventory of building equipment and their characteristics. His handwritten list details the type and location of equipment. As an example, the list describes an air handler in the cafeteria, its dimensions, type of belts, and characteristics of the motor (horsepower, amps, revolutions per minute, etc.). The inventory is a ready source of equipment information when needed, such as when replacing belts.

In the Fridley School District, a list of HVAC components and their characteristics provides useful information for preventive maintenance, such as replacing belts.

For some building components, such as elevators, where the school district lacks the expertise or equipment for adequate maintenance, the director contracts with private maintenance firms. He also brings in firms with expertise in particular building systems for inspections and ongoing assessments of building conditions. For example, each fall a mechanical firm walks through the buildings with the head custodian inspecting HVAC components. Roofing firms come in periodically with ultrasonic monitors to detect roof problems that might otherwise go unseen.

The additional inspections offer another set of "eyes and ears" with special knowledge that supplements the district's own work. Plus, the contracted firms have inspection equipment that would not be economical for the school district itself to purchase. The combination of in-house and contracted maintenance for preventive maintenance is especially necessary for jurisdictions that do not employ maintenance specialists for each of their particular building systems.

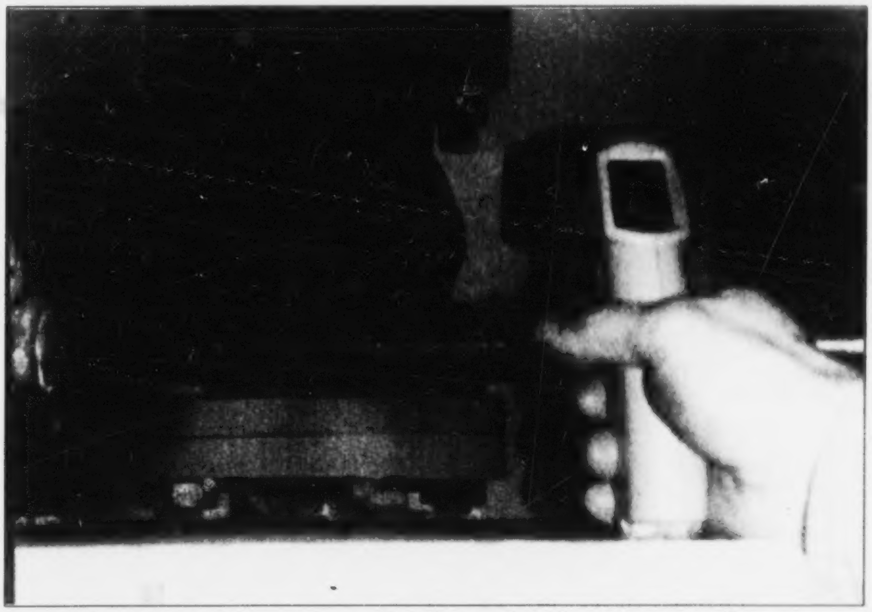
For more information contact:
Duane Knealing
Fridley Public School District Director of Maintenance
and Transportation
763/502-5008

City of North St. Paul's Preventive Maintenance

As part of preventive maintenance in the city of North St. Paul, the building maintenance division uses checklists, handheld test equipment, and regular inspections. For efficiency, the building maintenance foreman coordinates multiple maintenance tasks. In part because the city is considering constructing a new administrative building, the maintenance division also uses cost-effective procedures to control inventories of parts.

To ensure building components are inspected and maintained according to schedule, the maintenance foreman uses checklists to record observations and check off completed maintenance activities. Each component of a boiler or cooling tower, for instance, receives attention. To supplement observations, the maintenance foreman uses handheld equipment, such as temperature sensors and electrical meters, to determine whether systems are functioning correctly. The instruments help detect and diagnose the source of problems before they escalate and enable staff to take the proper corrective action, such as adjusting the tension on motor belts or repairing refrigerant leaks.

Because some city buildings do not have automated building control systems, the handheld tools also help assess and control daily indoor air quality by providing instant readings of conditions. Maintenance personnel make immediate adjustments to temperature and airflow without needing a consultant to diagnose minor system problems.



Temperature sensors detect system malfunctions and confirm proper operations.

The maintenance foreman periodically instructs other city and maintenance staff about the causes of indoor air problems and steps they can take to reduce irritants, such as mold and dust. As part of their efforts to maintain quality indoor air, maintenance personnel regularly disinfect HVAC equipment and change filters using high-quality replacements. They also monitor and control proper fresh air intake. Other steps include comparing maintenance procedures with other jurisdictions and contractors to identify effective maintenance practices.

To save time, the North St. Paul foreman changes filters in air-handling units while on the roof inspecting for leaks.

To save time when visiting building sites, the maintenance foreman coordinates multiple tasks for building components. For instance, at the same time the foreman inspects roofs for tears and cleans gutters, he also inspects rooftop air-handling units and changes their filters. As another example, the maintenance foreman draws water samples from the cooling towers, chillers, and boilers and sends the samples out together for testing.

Confronted with space limitations and an aging city hall, the city minimizes its investment in equipment inventories as it plans for the new facility. Rather than keep inventories of backup parts and equipment for old systems that are nearing the end of their useful life, the maintenance foreman keeps a list of suppliers with the appropriate equipment. As part of this strategy, the maintenance foreman periodically verifies that suppliers have the necessary parts on hand.

Small jurisdictions, especially those without automated building systems, can benefit from handheld diagnostic tools that help avert system problems before they grow. Some tools can cost as much as several hundred dollars, however, North St. Paul maintenance personnel believe that when used consistently and correctly, the instruments are invaluable for effective preventive and predictive maintenance. The instruments require some training for proper use, but they are less expensive than hiring consultants to diagnose minor problems. Jurisdictions considering replacing older building components may realize cost benefits from retaining low supply inventories, however, those with outdated systems or lacking easy access to supplies run the risk of interrupting services and should monitor the availability of supplies.

For more information contact:
Gary Lofquist
North St. Paul Building Maintenance Foreman
651/770-4450

South St. Paul School District's Procedures for Defining Workers' Responsibilities

The South St. Paul School District maintains approximately 650,000 square feet of building space (in the top one-third largest square footages among districts in the state). The Building Support Services Department assigns tasks according to workers' skill levels and follows guidelines when contracting for services.

Custodians' daily worksheets include tasks for monitoring building systems in the South St. Paul School District.

The department delegates maintenance tasks according to employees' skill levels. While maintenance workers are responsible for systems in their own areas of expertise, custodians conduct minor preventive maintenance tasks, such as changing air filters and checking water temperatures. Custodians follow a daily maintenance worksheet to check the status of building systems. They record signs of system failure or dysfunction and report their findings to the designated system experts, who follow through with the necessary maintenance.

To determine whether to retain contractors for particular maintenance projects, the director first analyzes the skills, time, and equipment available in-house. The director also compares the estimated time to complete a project against the available personnel hours, and determines whether the added project will adversely affect ongoing maintenance. For major projects or those that require special equipment, school maintenance personnel perform as much of the project as possible; the department contracts out the remaining tasks. School administrators believe they consistently reduce costs this way.

For more information contact:
Glen Birnstengel
South St. Paul School District Director of Building Support Services
651/457-9431

Wabasha-Kellogg School District's Procedures for Defining Workers' Responsibilities

Following a consolidation of three buildings into a single complex, the Wabasha-Kellogg School District decided to analyze its combined maintenance positions in 1994. As a result, the district now follows a systematic process to designate maintenance responsibilities, route work orders, and schedule tasks.

To help with the analysis, the school district hired a consultant to assess its process for providing maintenance services, the volume and type of maintenance tasks, and workers' skill levels. The consultant developed comprehensive job descriptions and timetables for each maintenance worker as a way to improve worker efficiency while preserving time for maintenance activities.

Maintenance workers in Wabasha-Kellogg School District follow schedules with designated times for preventive maintenance.

School administrators also modified the work-order system to route all maintenance work orders through the buildings and grounds supervisor. The supervisor schedules maintenance tasks by their type and assigns them to workers according to their job duties. Each maintenance worker follows a regular daily schedule with designated time periods for specific activities, such as for preventive maintenance, updating records, or cleaning restrooms. Daily schedules allow time for unscheduled repairs or unforeseen tasks.

Since implementing the changes, the school district has been able to eliminate a part-time position while increasing worker productivity. According to school officials, the cost savings and benefits of improved worker performance outweigh the $6,000 spent for the study. The work-order system and daily schedules inform maintenance workers about what is expected of them, as well as help them complete tasks in a timely manner. The procedures establish a consistent approach to assigning and providing maintenance, as well as foster accountability for specific tasks among maintenance workers.

For more information contact:
Larry Kronebusch
Wabasha-Kellogg School District Buildings and Grounds Supervisor
651/565-3559 ext. 203

Anoka-Hennepin School District's Indoor Air Quality Program

The Anoka-Hennepin School District follows an indoor air quality program that includes a program coordinator, specific preventive maintenance practices, a comprehensive instructional manual, and periodic updates on indoor air quality activities. The program helps the school district manage indoor air quality and quickly resolve air quality complaints.

In the late 1990s, the school district formed a committee of staff and parents to address indoor air quality concerns. The committee identified key strategies for improving air quality, such as educating building occupants and modifying maintenance practices, and then developed a plan to implement the program.

Using federal aid, the district hired a consultant to conduct a base-line assessment for comparing future outcomes of its air quality management practices.

With Health and Safety Revenue, the district funds a full-time position to coordinate program activities, train school personnel, and handle air quality complaints. The coordinator worked with school administrators and consultants to develop a comprehensive guide for building construction and maintenance standards. The guide specifies practices for moisture protection, chemical usage, construction cleanup, and addressing environmental issues, among many other items.

To improve air quality, the buildings department in Anoka-Hennepin School District increased inspections and sanitation of HVAC components.

The district also developed a manual, based in part on the Environmental Protection Agency's *Tools for Schools,* for building occupants. Among other information, the manual includes guidelines for controlling air irritants, such as dander from pets used for classroom instruction; procedures to resolve air quality complaints; and answers to frequently asked questions.

As part of the program, the buildings and grounds department modified its preventive maintenance practices. The department increased inspections and sanitation of HVAC systems, upgraded supplies and cleaning equipment, and revised cleaning standards for school buildings. The coordinator also periodically trains maintenance personnel and educates contract workers on procedures to manage indoor air quality.

To keep parents and building occupants informed about the program, the coordinator mails out annual bulletins summarizing the district's recent activities and future plans. The buildings and grounds department also addresses indoor air quality issues in its monthly bulletin to school administrators and building supervisors.

According to Anoka-Hennepin School District officials, benefits of the program include fewer air quality complaints annually since implementing the program, as well as more efficiently operating building systems due to increased preventive maintenance. Although it is difficult to estimate the district's overall costs to improve indoor air quality, school officials suggest implementing the program required a substantial investment of time and money. For instance, the district's initial costs included more than $125,000 to upgrade cleaning equipment for all buildings. Ongoing program costs include the coordinator's salary and postage for mailings. The district uses Health and Safety Revenue to help fund the program. As the Anoka-Hennepin School District found in preparing its manual, using materials prepared by federal or state agencies can reduce time and costs.

For more information contact:

Louis Klingelhoets
Anoka-Hennepin School District Director of Buildings and Grounds
763/506-1228

Other jurisdictions we visited demonstrated best practices in operating a preventive maintenance program. Some are listed here along with contact names.

City of Brooklyn Park, Steve Lawrence, Central Services Superintendent, 763/493-8028;
Carver County, Robert Darnell, Director of Buildings, 952/361-1512;
City of Melrose, Don Salzmann, Public Works Director, 320/256-4666 or Rose Ann Inderrieden, City Administrator, 320/256-4278;
Rosemount-Apple Valley-Eagan School District, Steve Hanson, Director of Buildings & Grounds or Ken Brandel, Maintenance Supervisor, 651/423-7702;
Worthington School District, David Skog, Director of Management Services, 507/372-2172.

5. Use Tools to Optimize the Preventive Maintenance Program

RECOMMENDATION

To gain optimum benefits from preventive maintenance, building managers should incorporate preventive maintenance tasks into a work-order system and keep systematic maintenance records, either by computer or manually. Managers should evaluate the preventive maintenance program to improve it over time. For added efficiencies, building managers should look for opportunities to share preventive maintenance.

Use a Work-Order System

A work-order system is a standard way of processing maintenance work, whether the job originates as a problem communicated by building users or as part of planned maintenance projects. It controls the large numbers of job requests that maintenance personnel typically face. A work-order system provides uniformity in planning maintenance jobs. Using work orders for upcoming preventive maintenance tasks helps ensure that this work does not get abandoned amidst multiple maintenance jobs.[103]

By analyzing completed work orders, building managers can track recurring problems in a piece of equipment. Work orders may also provide a written record of actual work done each day, as well as the number of hours to complete tasks, parts needed for the job, and feedback on the completed work.[104] More sophisticated work-order systems provide information for measuring worker productivity.

---

[103] Thomas A. Westerkamp, *Maintenance Manager's Standard Manual*, 2d ed. (Paramus, NJ: Prentice Hall, 1997), 92 and 125. For a sample work-order form see: Westerkamp, *Maintenance Manager's Standard Manual*, 94.

[104] Melvin, *Plan, Predict, Prevent*, 31 and 35.

Keep Systematic Records

All the actions discussed above, from assessing the condition of buildings to scheduling preventive maintenance tasks, require keeping data. For many jurisdictions, particularly those with multiple buildings, keeping accurate records means having a system for retaining and managing their maintenance information. The purpose of a "management information system" is to make sure that building managers have sufficient information to properly oversee maintenance work.

Information systems range from sophisticated computer programs to simple index cards.

An information system allows managers to compare budgeted to actual costs and evaluate department performance.[105] Information on maintenance histories can help determine equipment's expected remaining life spans. Trend data on maintenance and repair costs provide useful information for estimating budget items.

Together with preventive maintenance inspections, an information system allows building managers to efficiently identify building problems before major failures occur.[106] When analysis of records shows problems, such as noisy bearings that recur over a number of inspections, maintenance personnel can take corrective steps.

Some jurisdictions will require more sophisticated information systems than others. At one end of the spectrum are computerized maintenance management systems. These systems automate many management features such as generating and analyzing work orders, storing building condition information, and tracking preventive maintenance tasks.[107] Some also integrate programs for financial management and energy management control systems. Some help determine what staffing levels and contract-labor hours are necessary based on estimates of maintenance projects' hours and costs.

At the other end of the spectrum, jurisdictions with a limited number of facilities may find it impractical to invest in a computerized management information system.[108] For them, a systematic way of manually recording information can suffice, such as using simple index cards to list the frequency of preventive maintenance tasks.

As shown previously in Table 2.6,

- **21 percent of school districts and 16 percent of cities and counties responding to the survey reported that they keep comprehensive records of preventive maintenance activities and their costs for most of their building components.**

---

[105] Kaiser, *The Facilities Manager's Reference*, 106.

[106] Avedesian, *How to Design and Manage Your Preventive Maintenance Program*, 34.

[107] *Ibid.*, 35.

[108] *Ibid.*, 37.

Of school districts that actively perform preventive maintenance, 22 percent (64 districts) had some type of management information system for maintenance in 1998-99. Ten percent of districts (30 districts) active in preventive maintenance reported having a computerized system and 12 percent (34 districts) a manual system.[109]

Evaluate the Program

To improve the quality of preventive maintenance, building managers should periodically evaluate the maintenance work.[110] Planned, ongoing evaluations help identify what aspects of the program need improvement. They also identify what is working successfully and should continue into the future. Data collected through evaluations help determine the costs and benefits of preventive maintenance practices. According to the survey:

- **Of school districts that actively perform preventive maintenance, 43 percent (123 districts) reported that they used some method to evaluate their preventive maintenance.[111]**

Building managers may evaluate preventive maintenance in any of several ways, some of which are described below.

Preventive maintenance evaluations take various forms, including benchmarking and surveying building occupants.

- Set measurable, formal goals for the program and measure progress toward meeting them. This usually involves "benchmarking," or comparing measures of performance (such as the percentage of work orders completed within three days) against a base line in the jurisdiction or top performers elsewhere. Comparing the preventive maintenance program's results in a given year to earlier years yields information on the program's progress.[112]

- Analyze work orders to mark progress in the preventive maintenance program. As the ratio of preventive maintenance work orders to emergency orders improves, building managers may be able to measure a shift toward planned maintenance and away from crisis maintenance.[113]

- Analyze how closely the department adhered to the schedule of preventive maintenance tasks for the year.[114]

---

[109] We did not collect similar data from cities and counties.

[110] Cotts, *The Facility Management Handbook*, 270-272.

[111] The percentage of cities and counties that evaluate their preventive maintenance was not available.

[112] Cotts, *The Facility Management Handbook*, 270.

[113] Melvin, *Plan, Predict, Prevent*, 35.

[114] Cotts, *The Facility Management Handbook*, 271.

- Survey building users with questionnaires that elicit their levels of satisfaction with building conditions.

- Track how frequently equipment breaks down or malfunctions; equipment that is routinely maintained should have a better maintenance history.

- Set standards for various tasks performed by employees. Once employees understand the standards, managers periodically inspect employees' completed work to measure how well it meets the standards.

Table 2.8 shows the methods that Minnesota local jurisdictions reported using to evaluate preventive maintenance.

Table 2.8: Methods Used to Evaluate Preventive Maintenance, 1999[a]

Method	School Districts (*N*=285)	Cities and Counties (*N*=167)
Survey building occupants to assess satisfaction levels with building environments	29.1%	53.9%
Analyze costs and benefits of preventive maintenance to quantify savings	24.6	44.9
Review preventive maintenance records to identify potential problems	21.8	50.3
Follow quality assurance program with maintenance work standards and inspections of completed work	17.9	12.6
Compare trends in frequency of malfunctioning equipment	17.5	41.9
Measure progress toward meeting preventive maintenance goals	17.5	22.2

[a] Includes only local jurisdictions indicating they actively performed preventive maintenance.

Explore Efficiencies of Shared Arrangements

Jurisdictions may gain efficiencies in sharing maintenance expertise or equipment.[115] Sharing services is most conducive in situations where units of government have compatible needs or serve the same population. It may produce more or improved services, avoid duplication, get maximum use out of facilities, and save money through joint use of infrequently used equipment. This is true of sharing between jurisdictions or among departments within a single jurisdiction. Equally important, sharing preventive maintenance information improves the knowledge and abilities of maintenance personnel, which can lead to better service.

---

[115] Christine A. Everson, "Local Governments and Schools: Sharing Support Services," *International City/County Management Association Management Information Service Reports* 26, no. 5 (May 1994): 1, 4.

Sharing maintenance can improve services, reduce duplication, and maximize use of facilities.

According to the survey,

- **Of jurisdictions that actively perform preventive maintenance, 11 percent of school districts (31 districts), and 34 percent of cities and counties (69 jurisdictions), reported sharing preventive maintenance services.**

Most of the sharing reported by cities and counties was with other departments within their own jurisdiction. In a small number of cases, jurisdictions indicated they shared preventive maintenance services specifically for facilities jointly owned with another local government unit.

Sharing support services such as maintenance takes time and requires significant advance work. Studies have shown that successfully shared services typically exhibit certain characteristics.[116] Local jurisdictions in these arrangements often have established relationships either from past activities or because of personal relationships between officials or staff. Top officials commit to the concept of sharing services. Local staff allow substantial time for advance planning. As part of their planning, they come to agreement on their overall goals. Plus, they put in writing their objectives, projects, and timelines for achieving them.

Examples Related to Using Tools to Optimize Preventive Maintenance

Anoka-Hennepin School District's Work-Order and Maintenance-Management Systems

The Anoka-Hennepin School District Buildings and Grounds Department uses a computerized maintenance management system to schedule preventive maintenance activities, track work orders, and record maintenance and repairs. The department began using the system in 1985 to effectively manage building maintenance for its rapidly growing school district.

The maintenance management system includes a comprehensive inventory of building systems, along with a yearly schedule of preventive maintenance tasks for the district's building components and equipment. For every preventive maintenance task, the system assigns a work-order number with a corresponding bar code. The system allows department administrators to query all preventive maintenance tasks by month, by building, by component, or by worker.

Every month, the buildings and grounds department sends to school building supervisors a computer-generated list of pending preventive maintenance tasks pertinent to their buildings. By the end of the month, maintenance workers verify completion of their tasks, or note why a task was not performed, and return the

---

[116] *Ibid.*, 3-4.

The Anoka-Hennepin School District closes work orders by scanning the barcodes located on the paperwork of completed projects.

work-order list. Office workers scan the bar codes of completed maintenance tasks to close work orders. The system helps the department maintain a comprehensive history of preventive maintenance activities and monitor building problems. As part of the department's quality assurance efforts, administrators use the system to track workers' activities and evaluate their performance.

To request technical assistance for repairs, school building supervisors submit maintenance work orders to the buildings and grounds department. Department administrators determine if in-house maintenance specialists or contractors will perform the work, schedule workers, set deadlines to complete repairs, order parts if necessary, and log the work orders into the system. The department then groups work orders by subject type and assigns responsibilities to appropriate technicians. After workers complete the repairs, they record pertinent information and return the work orders to the department to update the system and process invoices. The system allows administrators to keep information about repairs, such as the status of work orders, task completion date, type of repair, who did the work, the parts and supplies used, and the time it took to complete the task.

School officials believe additional benefits of the maintenance management and work-order system are an accurate inventory of outstanding maintenance needs and more efficient management of maintenance workers. Although comparable computerized maintenance systems can cost as much as $25,000, school officials believe their system is essential to manage their many buildings effectively. For the system to be useful, building supervisors and maintenance workers must record pertinent information about maintenance activities, and department administrators must consistently update records.

For more information contact:
Louis Klingelhoets
Anoka-Hennepin School District Director of Buildings and Grounds
763/506-1228

Hennepin County's Computerized Preventive Maintenance Program

In Hennepin County, the Property Services Department has used an automated preventive maintenance software program for more than ten years. Employees use the program to perform and track preventive maintenance in county-owned and leased buildings.

Building engineers have computer access to the preventive maintenance software at their sites around the county. They are responsible for overseeing and then recording the completion of preventive maintenance activities that the program lists. The program contains countywide information on thousands of pieces of equipment and hundreds of thousands of past and current projects.
Most but not all building components are part of the preventive maintenance program. Generally, the Property Services Department uses the program to schedule maintenance for components that are automated and would cause major building problems if they were to fail, such as the HVAC, plumbing, and

electrical systems. Carpeting, interior painting, and windows are inspected but are not in the preventive maintenance software. The reasoning is that a carpet tear, for instance, will not automatically cause other damage but a malfunctioning pump could quickly result in flooding, creating numerous other problems.

The Property Services Department uses its own experience and planning along with the preventive maintenance program. As an example, although the preventive maintenance program calls for roof inspections, it does not specify their frequency, so the department includes twice-yearly roof inspections in its Facility Maintenance Plan.

Besides the direct benefits associated with the preventive maintenance program's regularly scheduled maintenance, a secondary benefit is useful information the program yields, such as equipment maintenance histories. For instance, a particular motor manufacturer recommended annual greasing, but based on the county's experience with the motors' history of breakdowns, staff changed the schedule to grease semiannually and have since prevented further disruptions.

After monitoring the history of motor breakdowns, Hennepin County increased its frequency of greasing parts.

Over the years, the Property Services Department has refined the computerized preventive maintenance program to improve its workability. A recent improvement was converting the computer program to a more user-friendly operating platform and linking it with the department's work-order system.

Smaller jurisdictions with minimal square footage may not require computerized programs for tracking preventive maintenance. For those considering a computerized preventive maintenance program, Hennepin County's Property Services Department recommends selecting one that is easy for staff to understand and simple to use, or it could go underutilized. Whether computerized or not, a successful preventive maintenance program requires knowledgeable workers qualified to implement it.

Jurisdictions beginning a preventive maintenance program should have a thorough inventory of the number and type of their building components and equipment. Incomplete data could nullify the program's intended benefits. For economy, a program should be tailored to meet the jurisdiction's own needs; in Hennepin County's case, the division purchased the "preventive maintenance" and "work order" modules of a computerized program but opted against buying the "inventory" and "purchasing" modules. A variety of computerized maintenance programs is available, with some basic software at about $400.

For more information contact:
Gary Grufman
Hennepin County Facilities Manager
612/348-3825

City of North St. Paul's Record Keeping

In North St. Paul, the building maintenance division uses field logbooks, pictures, and a computerized information system to record preventive maintenance activities. Regularly updated information on maintenance and repairs allows building administrators to monitor equipment problems and changes in building conditions.

While performing preventive maintenance, the maintenance foreman records activities in logbooks containing standardized forms and information for each building component. The forms contain detailed information on the location, model, energy source, and size of a component, as well as similar information for its parts. They allow the foreman to easily access building components' records while in the field; he can adjust preventive maintenance tasks if necessary. In addition, the director carries a handheld voice recorder to note any unique observations about system components.

The North St. Paul foreman photographs building problems to supplement records.

As a supplement to written records, the maintenance foreman photographs evidence of system failure, such as ceiling cracks or pipe leaks. When taken over time, the photos illustrate the progress and severity of problems and are a useful reference for professional consultants.

The maintenance director transfers maintenance and repair information from the field logbooks into the department's management information system. The software, developed in-house with a spreadsheet, allows the user to search building component records according to building, system identification number, activity date, and model numbers, among other items. Maintenance personnel believe the information system is essential to accurately track the history and performance of building components. It also provides background information for inspections by outside personnel, such as for boilers or fire-safety equipment.

Costs for a similar record-keeping system include personnel time to compile information on each component and develop forms for collecting field information. Costs for commercial computerized systems can run from several hundred to several thousand dollars. Users must update maintenance records consistently for the information to be useful.

For more information contact:
Gary Lofquist
North St. Paul Building Maintenance Foreman
651/770-4450

Hennepin County's Evaluation of Maintenance

To evaluate building maintenance, Hennepin County's Property Services Department has compared its maintenance operations to several benchmarks of service compiled by the International Facility Management Association (IFMA). Through a survey of its members, IFMA gathered data on facility performance and costs. The benchmarks reflect many different indicators of facility performance, including maintenance costs and the timeliness of the organization's response to work orders.

Although collecting building information for the benchmarking process was time consuming, the department viewed it as valuable. Hennepin County compared favorably on the majority of benchmarks. Where department employees identified costs that were higher than a benchmark, they investigated causes. They have contacted some of the facility management organizations in other states that participated in the IFMA benchmarking and have exchanged information about their respective programs. The division plans to continue participating in the benchmarking.

The department also follows up on work orders to determine that they are completed correctly and on a timely basis. As an initial step, the department developed work guidelines and instructions so employees know what is expected during various tasks. For example, the department's Facilities Maintenance Plan contains a diagram with procedures for proper cleaning of roof drains.

Building managers oversee the work by forwarding work orders to the appropriate trades people and then signing off when the work is completed. They are also responsible for seeing that the work is done in a timely manner. Building engineers make random checks of projects to ensure they were done correctly.

To ensure quality, Hennepin County building engineers make random checks of completed maintenance projects.

Another evaluation tool involves reviewing trends in equipment breakdowns. If equipment records indicate a pattern of motor malfunctions, for example, employees might increase the frequency of lubricating moving parts. Although reviewing equipment trends takes time to do correctly, the department's computerized preventive maintenance program makes it a more efficient and accurate process, and the review prolongs equipment's usefulness.

Finally, the Property Services Department is planning a "customer" survey of building users. The intent is to find out occupants' perspectives on how well the department is doing and areas it can improve. To keep costs down and to ensure the questions are useful, the department is basing its questionnaire on a similar survey developed by the IFMA. Once the survey receives final approval within the department, it will be sent to a random number of employees from all job classifications in buildings the department manages. Costs for the project include the time and money for developing, distributing, and then analyzing the survey.

For more information contact:

Gary Grufman
Hennepin County Facilities Manager
612/348-3825

Fridley School District's Sharing of Maintenance Services

The Fridley School District has cooperated with the city of Fridley on the joint use of building space. They share the use and maintenance of a community center and of a gymnasium in one elementary school.

The school district sold bonds in 1996 for major building improvements, which included plans to modify an elementary school gymnasium. When the city's parks and recreation director learned of the plans, he exchanged information with the school district's maintenance director on the city's need for a basketball and volleyball court. Their interactions led to a formal sharing arrangement between the two jurisdictions. The city added $150,000 to the amount the school district planned to spend, providing enough to construct a full-size gymnasium. The school's gym now accommodates the school's needs as well as the city's recreational leagues.

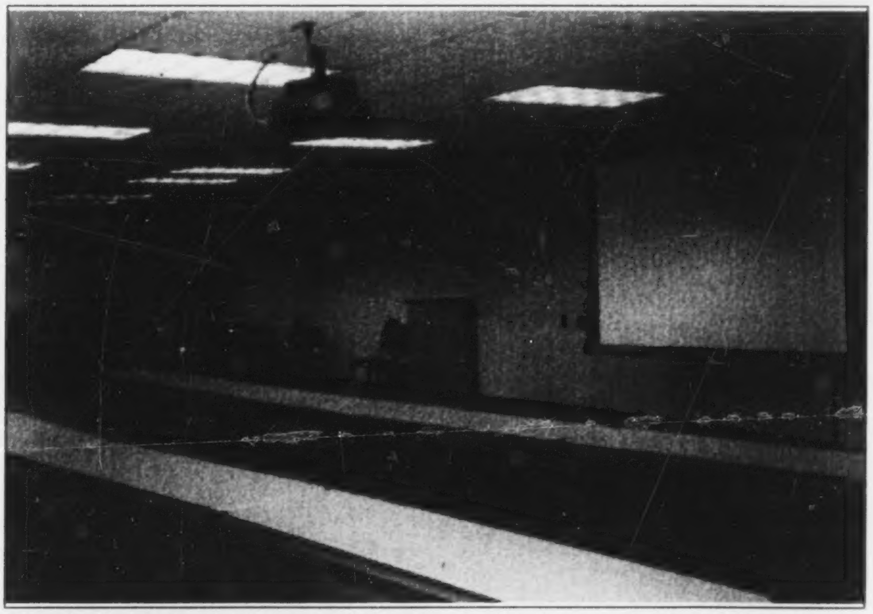
Besides sharing construction costs, the city and school district agreed on a shared maintenance arrangement. The school district provides all maintenance of the gym space. In exchange, the city pays a portion of the annual utility costs and the two jurisdictions evenly divide the costs for a yearly refinishing of the gymnasium floor. Joint use of the space requires advance scheduling: The city has use of the gym after 3:45 p.m. on weekdays unless the school has a special program. With the shared construction and maintenance, both jurisdictions gain use of upgraded gym space that they would not have been able to afford as easily on their own.

In exchange for school district maintenance of the gym, the city of Fridley pays a share of utility costs and half the cost of floor refinishing.

In another shared project, the city added $1.4 million to the school district's bonding project for a community center. Due to enrollment changes over the previous 15 years, the school district no longer needed elementary classroom space in one of its schools and decided to convert the building to other uses. Together the city and school district planned modifications to the building to accommodate their different needs, housing everything from the city's police and fire fighter training to the school district's special education classes.

The school district maintains the community center. For certain projects, such as constructing cabinets in the youth center, high school students contributed their labor as part of a combined school and city project. The school district and city share in paying maintenance costs. For similar cooperative arrangements to work elsewhere, elected officials from the participating jurisdictions have to support the effort, and staff from both jurisdictions need to commit time to advance planning. Written agreements should spell out each participating jurisdiction's expectations and responsibilities.

In addition to the shared gymnasium and community center, the city and school district have agreements on the use of city parks at two elementary school sites. The city, for example, owns an ice-warming house that the school district maintains in exchange for its use during certain hours. The city parks and recreation department has access to school district-maintained grounds and fields during evening hours and summer months when the school is not using them.



The school district maintains space that is also used by the city. Both jurisdictions share maintenance costs.

Beyond the formal agreements, the Fridley School District shares with the city parks and recreation department a number of maintenance tasks on a more informal basis. This informal sharing is done on an ad hoc basis and is not part of a written agreement. For instance, when the school district purchased crushed aggregate for ballpark infields, city workers used their front-end loader to spread it, saving time and money for the district.

The informal sharing is possible in large part because of a relationship of trust built between the city's parks and recreation director and the school district's maintenance director. Similar sharing may be more difficult to accomplish when a school district is very large or when it covers multiple cities' boundary lines, because it would require ongoing working relationships across many jurisdictions.

For more information contact:
Duane Knealing
Fridley Public School District Director of Maintenance and Transportation
763/502-5008

Foley School District's Sharing of Maintenance Services

In 1989 the Foley School District joined with five nearby Benton and Stearns county school districts in forming an "education district" to jointly provide a number of services, including certain maintenance activities.[117] Each of the six school districts pays for the shared services through a formula that splits one-half of all costs in six equal parts and apportions the remaining half of total costs to each district according to the size of its student population.

---

[117] The other school districts are Cold Spring, Kimball, Holdingford, Sartell, and Sauk Rapids. By law, education districts are governed by an education district board consisting of one member appointed by each of the participating districts' school boards. In a written agreement, the board determines what services to provide jointly.

A health and safety coordinator employed by the education district provides numerous maintenance-related services that would otherwise have to be purchased by each district separately. The coordinator was first needed as the designated asbestos inspector to work each year on controlling asbestos problems in the participating districts' buildings. By forming the education district, the school districts shared the costs of the asbestos inspector, including the $1,000 yearly cost of licensure for asbestos program management.

Six school districts, including the Foley School District, share the costs of asbestos management and related maintenance services.

Since the shared arrangement started, the health and safety coordinator's duties have grown to include a variety of other maintenance-related activities. Besides managing the asbestos program, he tests for lead in water, implements employee "right-to-know" requirements, and handles underground fuel storage issues. He also provides expertise on fire- and life-safety plans, ergonomics for custodial staff and kitchen workers, requirements of the Americans with Disabilities Act, and other matters related to Minnesota's Health and Safety Revenue for school districts. As issues arise, such as dealing with indoor air quality problems, he offers programs and technical assistance to maintenance employees in the six school districts.

The Foley School District has its own health and safety committee, headed by the supervisor of buildings and grounds. When the committee faces issues that require additional maintenance expertise, it contacts the education district's health and safety coordinator for help. For instance, the buildings and grounds supervisor has an indoor air quality program and follows practices, such as using citrus-based chemical solvents or painting with latex paint and after school hours, to minimize air problems. When the need arises for testing air samples, however, he turns to the health and safety coordinator who has the equipment and expertise to administer the tests.

Using the education district for these maintenance duties is cost-effective for the participating school districts, which would otherwise have to employ additional staff or contract for the services. For a yearly cost of about $60,000 divided among the six school districts, the participants receive maintenance expertise and services that school districts are required by law to have. In addition to the economy of the arrangement, the Foley School District is pleased with the immediate attention it receives from the health and safety coordinator, who serves only the six member districts. Similar arrangements may be most beneficial for small school districts; individually they may not need a full-time health and safety position but collectively they could receive the direct services required while sharing personnel costs.

For more information contact:

Darwin Fleck
Foley School District Supervisor of Buildings, Grounds and Custodial
320/968-7246 or

Dave Ostendorf
Benton-Stearns Education District Health and Safety Coordinator
320/252-8427

Other jurisdictions we visited demonstrated best practices for using a work-order system, keeping records, evaluating preventive maintenance, and sharing maintenance services. Some are listed here along with contact names.

City of Brooklyn Park, Steve Lawrence, Central Services Superintendent, 763/493-8028;
Detroit Lakes School District, Brad Green, Supervisor of Operations, 218/847-9271;
Duluth School District, Kerry Leider, Director, Facilities and Risk Management, 218/723-4118;
Rosemount-Apple Valley-Eagan School District, Steve Hanson, Director of Buildings & Grounds or Ken Brandel, Maintenance Supervisor, 651/423-7702;
South St. Paul School District, Glen Birnstengel, Director of Building Support Services, 651/457-9431.

6. Advance the Competence of Maintenance Workers and Managers

RECOMMENDATION

Local jurisdictions should ensure that their maintenance employees have appropriate training to competently and safely complete the tasks expected of them.

Require Ongoing Training to Match Duties Performed

Well-maintained buildings require highly trained workers.

Regardless of the size of the maintenance workforce, training should be available to improve employees' technical skills and meet their individual training needs.[118] Appropriate training represents an investment in helping a jurisdiction's employees reach their full potential. When targeted to an employee's individual needs, good training can improve competence and productivity.

Training is also necessary for job safety. The Occupational Safety and Health Administration (OSHA) requires safety-related training. Maintenance employees exposed to hazardous chemicals, for instance, must receive training, including information on methods of detecting the hazardous chemicals and measures they can take to protect themselves from the hazards.[119] As Table 2.9 shows, most school districts reported that they require training prescribed by OSHA.

---

[118] Westerkamp, *Maintenance Manager's Standard Manual*, 29; and Cotts, *The Facility Management Handbook*, 223.

Beyond safety training, the survey asked about training required of maintenance employees who were expected to perform related tasks. As shown in Table 2.9,

- **School districts were most likely to require training in the areas of general maintenance and repairs, preventive maintenance activities, and diagnosing causes of maintenance problems, in addition to OSHA-required training.**[120]

For some types of training, school districts did not require training even though employees may have been required to perform related tasks. The most common training not required was for management and leadership skills, communication skills, and analyzing the remaining useful life of building components and equipment.

Table 2.9: Training Required by School Districts for Maintenance Employees, 1998-99

Type of Training	Required of Employees Expected to Perform These Tasks	Not Required of Employees Expected to Perform These Tasks	Maintenance Employees Do Not Perform These Tasks
OSHA-required training, such as asbestos awareness or use of personal protective equipment (*N*=287)	95.8%	2.8%	1.4%
General maintenance and minor repairs (*N*=286)	76.6	21.7	1.7
Preventive maintenance activities (*N*=284)	65.5	29.9	4.6
Diagnosing causes of maintenance problems (*N*=277)	60.6	33.6	5.8
Energy conservation strategies (*N*=280)	46.4	40.0	13.6
New facility technologies (*N*=281)	36.7	37.4	26.0
Communication skills (*N*=277)	32.1	49.1	18.8
Analyzing the remaining useful life of facility components and equipment (*N*=280)	28.2	45.4	26.4
Management and leadership skills (*N*=280)	20.7	49.6	29.6
Budget development (*N*=280)	13.6	31.1	55.4
Public presentation skills and techniques (*N*=278)	9.4	41.7	48.9

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

---

[119] 29 *CFR* sec. 1910.1200(h)(3)(i-iv) (1998). Chapter 3 provides additional information on OSHA requirements.

[120] We did not collect similar data from cities and counties.

Training should be a continuous program, not a one-time event.[121] This is particularly true for staff maintaining buildings containing increasingly sophisticated and technically complex systems.[122] Lacking the appropriate training, employees may be unable to take full advantage of buildings' automated systems, resulting in less efficient operations.

A good training program requires planning and review.[123] Planning involves determining the training needs of individual employees and setting measurable learning objectives for them. It also means identifying appropriate courses, seminars, or other training to meet those needs. Good planning schedules training so that buildings continue to operate seamlessly while employees attend training sessions. Further, training planners need to periodically review the training program to assess how well the information employees acquire helps them on the job. Evaluations may indicate items in the training program that need to change.

The Minnesota Association of School Maintenance Supervisors provides yearly training opportunities for school district building managers and workers. Other organizations, such as the International Facility Managers Association, offer training and networking opportunities, although they are not designed specifically for public sector personnel.

In addition, certain occupations have their own licensing and training requirements. For instance, electricians must be licensed through the state's Board of Electricity.[124] The Board requires licensed electricians to successfully complete 16 hours of continuing education every two years.[125] Other occupations, such as boiler operators and asbestos workers, must also meet licensure and training standards specified by state rules.

Require Additional Training for Building Managers

Building managers may need training for leadership and communication skills.

Building managers, or those employees with specific responsibilities for managing or overseeing maintenance, may need additional training.[126] Those in leadership roles need managerial skills in addition to their hands-on maintenance skills. Managerial training needs will vary according to each manager's abilities and assigned responsibilities.

Although we are unaware of any universally accepted set of skills for all building managers, degree programs in facilities management give an indication of the material in which managers should be knowledgeable. According to the content of one school's degree program in facilities management, building managers should be equipped to manage: (1) human relations and personnel needs;

---

[121] ASBO International, *Principles of School Business Management*, 34.

[122] National Research Council, *Stewardship of Federal Facilities*, 55.

[123] Westerkamp, *Maintenance Manager's Standard Manual*, 30-31.

[124] *Minn. Stat.* §326.241, subd. 2(5).

[125] *Minn. Rules*, ch. 3800.3602, subp. 1-2.

[126] Westerkamp, *Maintenance Manager's Standard Manual*, 35-36.

(2) budgeting, financing, and purchasing practices; (3) use of computers in maintaining buildings; (4) effective contract specifications; (5) compliance with legal requirements; (6) daily building operations; and (7) effective preventive maintenance programs for preserving physical assets.[127]

Examples Related to Advancing the Competence of Maintenance Employees

Hennepin County's Maintenance Training

Hennepin County's Property Services Department has ongoing training requirements for its 57 employees. It requires annual training for each position on staff, including engineers, mechanics, utility workers, and environmental service workers. Training covers many facets of facility maintenance during any given year, including preventive maintenance but also multiple other topics.

Hennepin County maintenance workers are required to complete 24 hours of training each year.

Employees must successfully complete a minimum of 24 hours of training yearly. Some training is mandatory. Beyond that, an individual may receive additional training by request, such as a local class on electrical maintenance. During employees' performance reviews, employees and their supervisors discuss training needs and may identify other needed training. Employees at the management level may receive training to improve their administrative and leadership skills, in addition to maintenance-related training. The department views these skills as important for a fully functional management team. In the case of asbestos information, the county provides training not only to its own employees but also to contracted workers whose duties might result in disturbance to asbestos-containing building materials.

The department emphasizes training for employees because it believes that professionally managed operations and running building systems efficiently require high levels of training to maintain workers' expertise. Its annual training budget averages approximately $175 per worker. When training is necessary for a large number of employees, the department provides it economically by bringing in consultants to train 30 or so workers at a time in a classroom setting.

Ongoing training requires both a financial commitment to continually investing in the workforce and access to appropriate training opportunities. For Hennepin County, the availability of nearby training courses and seminars, such as those offered by Dunwoody Institute for example, allows access to many of the department's training needs. Jurisdictions located far from training centers may have difficulty finding training appropriate to their needs.

For more information contact:
Gary Grufman
Hennepin County Facilities Manager
612/348-3825

---

[127] Rutgers University Center for Government Services, "Public Schools Facilities Management" (New Brunswick, NJ: Rutgers State University of New Jersey, 1999); http://www.policy.rutgers.edu/cgs/pubschl.htm; accessed October 7, 1999.

City of Melrose's Maintenance Training

In providing training for city maintenance workers, the city of Melrose emphasizes job safety. For some training, the city requires and pays for attendance of all maintenance employees. In other cases, individual workers identify specific job-related training and the city pays the costs.

City officials look for economical ways to offer training. When possible, they arrange for city employees with special expertise to provide training sessions for maintenance employees. As an example, a member of the city's ambulance crew certified in emergency medical services taught a class on the risks of blood-borne pathogens. In general, this arrangement provides quality training at less cost than the city would pay for the comparable services and expenses of a consultant.

The city of Melrose coordinates safety training with other jurisdictions to reduce expenses.

To gain economies, the city coordinates some training sessions with nearby jurisdictions. For instance, Melrose coordinated safety meetings with the city of Sauk Centre and the local rural electric cooperative. It is less expensive per jurisdiction when they divide the costs of hiring a trainer. In addition, the staffs are of a size that adding employees to a training session typically does not hamper its quality.

Melrose city officials also take advantage of services offered through the city's insurer to identify training needs and improve employee safety. An insurance representative visits yearly to walk through city buildings and look over city equipment. During the inspection, the representative looks for potential problems that could be evidence of OSHA violations. In a written report following the inspections, the representative suggests actions the city could take. This might include changing maintenance procedures, modifying safety practices, or requiring a particular type of training for maintenance workers. The inspections add value by enhancing employee safety and lowering the city's risks; in addition, they do not cost any more than what the city already pays in its insurance rates.

For more information contact:

Rose Ann Inderrieden
Melrose City Administrator
320/256-4278 or

Don Salzmann
Melrose Public Works Director
320/256-4666

South St. Paul School District's Maintenance Training

To reduce workplace injuries, the South St. Paul School District Building Support Services Department employs a health and safety coordinator, holds periodic safety meetings for its workers, and provides OSHA-related training. The department also provides training to upgrade skills of its in-house maintenance personnel.

Employed by the district on a part-time basis, the health and safety coordinator ensures maintenance personnel complete safety training pertinent to the duties they perform. Twice a year, the coordinator holds one-day training sessions to maintain workers' skills and heighten their awareness of the risks encountered on their jobs, such as blood-borne pathogens or unexpected engine start-ups while servicing equipment. To accommodate maintenance schedules, training sessions occur when school is not in session. The health and safety coordinator holds additional safety meetings throughout the year for maintenance employees, some with instructional videos or guest speakers.

Work-related injuries have decreased in the South St. Paul School District since health and safety meetings began.

When new or upgraded building systems require additional maintenance expertise, the department prefers training its workers over hiring a consultant. As an example, when the district upgraded portions of its HVAC system to improve indoor air quality, the department paid to train a worker in proper maintenance of the new system. When personnel turnover results in a loss of certain skills, the department pays the training costs for workers to upgrade their licenses, such as boiler licenses. Workers are responsible for ongoing licensing costs.

Although highly skilled workers can result in higher salary costs, school administrators believe training their employees on recurring maintenance tasks is more cost-effective than hiring contractors. For some tasks, school administrators estimate the district saves as much as $30 per hour in labor costs. According to school administrators, the annual number of work-related injuries has consistently decreased since the district hired the health and safety coordinator in 1994. School district costs include hourly wages for training attended during normal work hours, $1,000 annually for tuition expenses, and the health and safety coordinator's salary.

For more information contact:

Glen Birnstengel
South St. Paul School District Director of Building Support Services
651/457-9431

Other jurisdictions we visited demonstrated best practices for training maintenance personnel. One is listed here along with a contact name.

Fridley Public Schools, Duane Knealing, Director of Maintenance and Transportation, 763/502-5008

7. Involve Appropriate Maintenance Personnel in Decision Making and in Communicating Building Needs

---

RECOMMENDATION

Local officials should include appropriate maintenance personnel in decisions on facility matters, including purchasing major components or designing new square footage. Doing so can provide insight into future maintenance needs and avoid unnecessary costs. Building managers should develop a multiple-level education strategy to address the differing information needs of their various audiences.

Consider Maintenance Needs Prior to Purchasing or Designing Components

Attention to maintenance needs is as important before the design and construction of a building as it is once a building is erected.[128] In considering options for replacing or adding equipment, knowing future maintenance costs for each option allows informed decision making. Adding the expected maintenance costs of equipment to the initial purchase price may reveal some options to be more economical than others over the long term.

Involve maintenance personnel early in the design process.

Although the initial purchase price may be higher, future savings yielded by trouble-free service and lower rates of deterioration often outweigh the up-front cost.[129] Low-maintenance items also reduce the chances that breakdowns will interrupt use of the building. As shown in Table 2.10:

- **45 percent of school districts reported that they consistently purchase building components designed to allow low-cost maintenance over time.**

In addition, when designing new or altered space, using a design team that includes maintenance perspectives along with the design professionals can help control future costs. When potential maintenance problems are identified early, such as during the design phase, they can be easily corrected. Further, considering maintenance needs can prevent poor design, such as lack of access panels needed to gain access to HVAC components for servicing. As another example, certain plumbing fixtures made of stainless steel are sturdier than others made of porcelain. In some environments, where high use or abuse of a component is expected, the added durability may be justified.

---

[128] U.S. ACIR and U.S. Army Corps of Engineers, *High Performance Public Works*, 29.

[129] Cotts, *The Facility Management Handbook*, 223.

Table 2.10: Considering Maintenance Needs in School District Decision Making, 1998-99

Practice (*N*=301)	Do Consistently	Do Occasionally	Do Rarely, If Ever
Purchase building components designed to allow low-cost maintenance over time	45.2%	47.2%	7.6%
Involve personnel with maintenance expertise in purchasing and/or design decisions	60.1	33.9	6.0

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

Maintenance personnel are typically suited to assess potential maintenance problems and anticipate future maintenance costs, producing a more complete picture of the total ownership costs of building components. By identifying maintenance requirements, maintenance personnel help determine full costs, thereby holding down life-cycle costs.[130] Table 2.10 shows that:

- **60 percent of school districts reported they consistently involve personnel with maintenance expertise in purchasing and design decisions.**

Educate Decision Makers about Building Needs

Building managers should target building information to their different audiences' needs.

Local jurisdictions' administrators and elected officials need information on maintenance projects and costs, albeit at a different level of detail than building managers.[131] Administrators appointed to run local jurisdictions—superintendents, city managers, and county administrators—need information on buildings' needs, alternatives to meet those needs, and costs. Similarly, those responsible for funding major maintenance projects—school boards, city councils, and county boards—need appropriate summary information to make cost-effective judgments.

According to the analysis:

- **Of those responding to the survey, 77 percent of school districts provide periodic reports on building conditions and needs to the school board or superintendent. Among city and county respondents, 37 percent said they report to policymakers on conditions and needs for most of their building components.**

The appropriate level of information will differ from jurisdiction to jurisdiction. One source suggests that elected officials and senior-level administrators should receive the following information on a periodic basis: replacement value of all buildings, building condition ratings, costs for replacing components based on their expected life cycles, levels of maintenance deficiencies, and a range of costs for correcting the deficiencies.[132] In larger jurisdictions, staff at lower levels in the organization should receive more detailed reports with historical trends on building conditions, inspection data, building deficiencies, current and future maintenance and replacement needs, expected costs of those needs, and alternative funding plans.

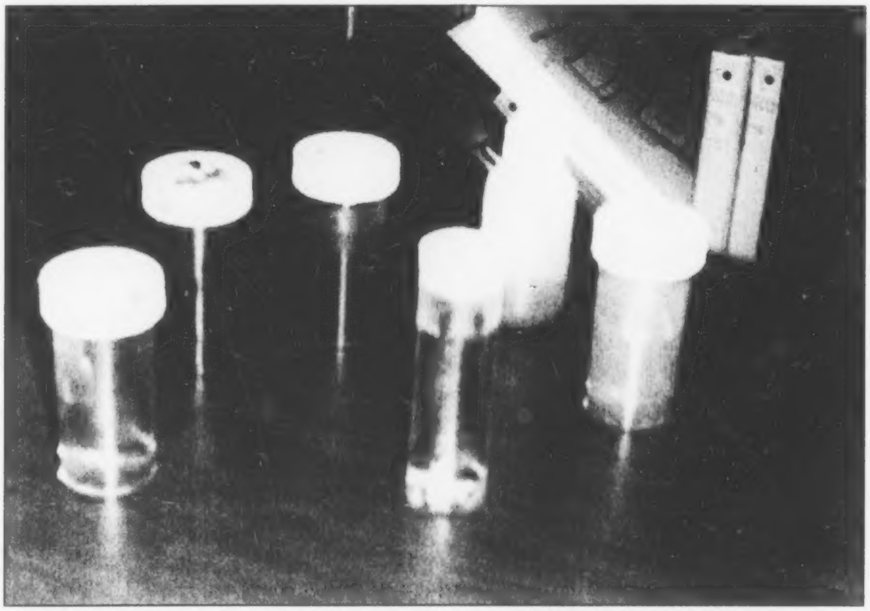
---

[130] U.S. ACIR and U.S. Army Corps of Engineers, *High Performance Public Works*, 51.

[131] *Ibid.*, 31; and Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 77.

Policymakers need to understand the consequences of deferring maintenance projects.

The flow of information should be ongoing. Although building information is commonly communicated at budget time, in some cases numerous presentations will be necessary to make decision makers fully aware of facility needs.
It is incumbent upon local officials to be aware of their jurisdiction's building needs. Not only should policymakers know about building conditions, but they should also understand the consequences when projects do not receive funding.[133]



Water samples are used as props to educate elected officials on the value of preventive maintenance.

That is, elected officials who defer maintenance projects should know the full implications of their decisions. Putting off roof repairs to some unknown time in the future, for instance, runs the risk of serious water damage to equipment and furnishings as well as interruptions in the daily use of the buildings, usually at far higher costs than the original project.

Armed with information on planned and deferred projects, officials have a more complete picture of building needs. Having the information is more likely to encourage local officials to consider future capital needs in the context of how the jurisdiction is expected to develop. Knowing that additional square footage is needed, for example, may force an earlier decision on updating a building's energy management system to coincide with the design and construction of the addition.

---

[132] Applied Management Engineering, PC and Rush, *Managing the Facilities Portfolio*, 78.

[133] Vaday, "Planning for Capital Improvements," 14.

Examples Related to Involving Maintenance Personnel in Decision Making and Communicating Building Needs

Aitkin County's Involvement of Maintenance Personnel

Together with the Aitkin County administrator, Aitkin County's senior maintenance worker brings his experience to help plan the capital building maintenance program. Each year he estimates a projected life for each of the major building components, including roofs, lighting, heating, and electrical, among others, in the county's courthouse complex. This information is included in a five-year capital plan along with estimates of major project costs for the year.

Aitkin County maintenance personnel proposed a cost-effective alternative to the original design.

The construction of a new jail in Aitkin County offered an opportunity to consider maintenance issues as the jail was being designed. Building maintenance personnel made a point of becoming involved in discussions of the HVAC design because of first-hand experience operating these systems.

One architectural design for the jail suggested using dry condensing gas-fired heating units located on the jail roof. Aitkin County's senior maintenance worker took the initiative to point out that the units have an expected lifetime of 10 to 12 years. In contrast, a penthouse heating system with a boiler could be expected to last far longer, up to 30 years. Energy costs would also likely be lower, because the gas-fired heating units could be expected to use about half again as much energy as the boiler.

The overall costs of purchasing, installing, and operating the penthouse system would be lower over time than for the suggested heating units, according to the maintenance estimates. Consequently, the county chose the former. Providing the maintenance perspective required assertiveness but proved valuable in the county's deliberations on final plans for the jail. Involvement of this kind also requires support from administrators in respecting the judgment of maintenance personnel.

For more information contact:
Bill Thompson
Aitkin County Senior Maintenance
218/927-7363

Wabasha-Kellogg School District's Involvement of Maintenance Personnel

The Wabasha-Kellogg School District Buildings and Grounds Committee, comprised of the superintendent, building and grounds supervisor, and three school board members, periodically meets throughout the year to review building conditions and needs. In addition, before upgrading buildings or systems, Wabasha-Kellogg school officials and maintenance personnel work together to review building plans and assess expected maintenance concerns.

A school board buildings committee in Wabasha-Kellogg School District reviews building plans with maintenance workers.

During the Buildings and Grounds Committee meetings, the superintendent and buildings supervisor update committee members about building deficiencies, proposed capital projects for the coming year, anticipated costs, and the urgency of each project. Including the building supervisor in the meetings gives decision makers his perspective on maintenance needs when weighing alternate project proposals. As part of the meetings, the school board members tour school premises to familiarize themselves with building conditions and capital needs. Committees of this kind require active support of policymakers and consideration of the maintenance perspective when making decisions.

In 1992, the district expanded the main school building by 66,000 square feet. During the planning process, school officials and maintenance personnel reviewed the durability and maintenance requirements of construction materials and roofing systems. For the new complex, the district selected a low-maintenance solid white block and mortar to match the existing white paint used to cover the gray block and mortar of the old building. While the district must periodically repaint the old building to maintain a white finish, it saves approximately $10,000 every seven years by avoiding painting expenses for the addition. The white block and mortar was slightly more expensive than the gray block and mortar of the existing building, however, the savings over the long term merited the choice.

For more information contact:
Larry Kronebusch
Wabasha-Kellogg School District Buildings and Grounds Supervisor
651/565-3559 ext. 203

Westbrook School District's Involvement of Maintenance Personnel

Administrators and maintenance personnel from the Westbrook School District meet twice a year with two members of the school board. With backgrounds in construction and the building trades, these two board members form the Buildings and Grounds Committee, along with the superintendent, principal, maintenance foreman, and head custodian. The meetings provide a forum for discussing pending building and equipment needs, as well as associated expenditures and safety concerns. School personnel update committee members about building conditions and the status of current maintenance and repair projects. The committee holds the meetings while school is in session and during after-school activities so school board members can view building needs in the context of the day-to-day learning environment.

To gather information on building conditions and needs, members of the Buildings and Grounds Committee conduct an annual tour of the buildings and grounds. The tours typically last one-half day and include an inspection of roofs, major building systems, and interior and exterior finishes. For projects involving large expenditures, all school board members participate in tours, and school officials enlist the services of a consultant to assist in evaluating building needs. The tours help familiarize decision makers with the district's physical plant, and enable maintenance personnel to point out specific deficiencies to board members. Board members are also better able to evaluate requests for expenditures and alternative solutions.

Meetings with maintenance personnel equip Westbrook School District board members to make informed building decisions.

Key maintenance personnel also have input on major construction projects. School officials involved the head custodian and maintenance foreman in the planning and specifications process for a recently completed $370,000, 30,000-square-foot addition to the main school complex. As part of the district's quality-assurance efforts, board members, maintenance personnel, and school administrators each periodically toured the construction site to monitor activities. School officials believe that by involving maintenance personnel in planning major projects, the district benefits from having multiple perspectives, resulting in more informed decision making.

For more information contact:
Stephen Kjorness
Westbrook School District Superintendent
507/859-2141

Other jurisdictions we visited demonstrated best practices for involving maintenance personnel and communicating building needs. Some are listed here along with contact names.

Carver County, Robert Darnell, Director of Buildings, 952/361-1512;
City of Melrose, Don Salzmann, Public Works Director, 320/256-4666 or Rose Ann Inderrieden, City Administrator, 320/256-4278;
Worthington School District, David Skog, Director of Management Services, 507/372-2172.

3

Local Government Use of Preventive Maintenance

SUMMARY

Most school districts, cities, and counties reported that they perform some preventive maintenance on their buildings, but only about 15 percent have a comprehensive preventive maintenance program for most of their building components. School districts with comprehensive preventive maintenance were more likely than other districts to report having most facility components in good condition. Although most school districts have a districtwide office to oversee building maintenance, responsibility for building maintenance in cities and counties is often more decentralized. Local governments reported that the greatest obstacles to preventive maintenance are competition for limited dollars, levy limits imposed by state law, and insufficient staff hours available for the work. Cities and counties fund preventive maintenance primarily with their own resources, but the state's school funding policies play a large role in school district maintenance funding.

This chapter provides additional information on preventive maintenance for Minnesota's local government buildings, including which local governments use it, how they fund it, obstacles to preventive maintenance, and the state's role. In this chapter we address the following questions:

- **Which local governments in Minnesota use best practices in preventive maintenance for their buildings? Do they share certain characteristics, such as building age or square footage? Do school districts, cities, and counties manage their maintenance programs differently?**

- **What obstacles limit local governments' use of preventive maintenance?**

- **How do school districts, cities, and counties fund preventive maintenance? What role does the state play in the funding? What state laws and rules affect preventive maintenance performed by cities, counties, and school districts?**

To answer these questions, we relied in part on our 1999 survey of Minnesota's school districts, cities, and counties.[1] Survey data are self-reported; we did not verify the veracity of local governments' survey responses. City and county survey data pertain to local practices as of the fall of 1999, when surveys were completed. School district data pertain to the 1998-99 school year. For other information in this chapter we reviewed Minnesota statutes and rules pertaining to building maintenance. (Appendix A contains detailed information about our methodology. Aggregate results from the surveys are available on our web site at http://www.auditor.leg.state.mn.us/ped/2000/pe0006.htm.)

---

[1] Of our survey responses from 308 school districts, 49 percent came from facility managers, 36 percent from superintendents, and 15 percent from business officers. When appropriate, we present survey results by each of these groups.

SCOPE AND STRUCTURE OF PREVENTIVE MAINTENANCE VARY

Although many local governments perform preventive maintenance, the scope of preventive maintenance programs varies. Some jurisdictions have very complete preventive maintenance programs, using most of the best practices identified in Chapter 2, while others have less complete programs. Within a single jurisdiction, maintenance personnel may perform preventive maintenance for some, but not most, building components.

Most local jurisdictions reported performing at least some preventive maintenance.

Most local jurisdictions reported that they performed at least minimal preventive maintenance for some of their building components. Virtually all school districts, about 70 percent of cities, and 85 percent of counties, reported having elements of a preventive maintenance program for at least some of their building components. These relatively high percentages are somewhat misleading, however. They include jurisdictions that reported performing maintenance for only some building components; they also include jurisdictions with very few of the best practices needed for a comprehensive preventive maintenance program.

Comprehensive Preventive Maintenance Programs

A more accurate picture of local government involvement in preventive maintenance would reveal jurisdictions that reported performing best practices in preventive maintenance for most or all of their building components. We looked at several specific activities (a subset of the best practices described in Chapter 2) to determine which local governments had a comprehensive preventive maintenance program. The activities included:

(1) scheduling and conducting regular inspections and maintenance on building components,

(2) monitoring building conditions and keeping current inventories of them,

(3) preparing checklists describing preventive maintenance tasks for employees to perform,

(4) keeping comprehensive records of preventive maintenance activities and their costs,

(5) reviewing preventive maintenance records to detect and correct problems before they escalate,

(6) developing procedures manuals with guidelines for planning and managing preventive maintenance,

(7) maintaining a supply of materials and spare parts to support timely maintenance,

(8) performing preventive maintenance according to formal, written plans, and

(9) reporting periodically to local officials on building conditions and needs.

In our judgment, jurisdictions had a comprehensive preventive maintenance program when they met two conditions: First, they reported in their survey responses that they scheduled inspections and maintenance according to manufacturers' recommendations or at other set intervals (the first activity noted above) for most building components. Second, they reported engaging in at least five of the remaining eight activities listed above for most of their building components. Although other definitions of a comprehensive preventive maintenance program could also be legitimate, based on our definition we found:

- **Of local governments responding to our survey, 15 percent reported having a comprehensive preventive maintenance program, including scheduling inspections and maintenance according to manufacturers' recommendations or other set intervals, and using preventive maintenance practices for most of their building components.**

About 22 percent of school districts, 11 percent of counties, and 6 percent of cities met our definition of comprehensive preventive maintenance. As reported later in this chapter, local governments identified a number of obstacles that they believe limit their ability to perform preventive maintenance.

Characteristics of Local Governments Using Preventive Maintenance

The size and age of school buildings were not related to the use of comprehensive preventive maintenance.

To help us analyze variations in local governments' preventive maintenance programs, we looked at several factors that might affect school districts' use of preventive maintenance: square footage of building space, average age of district buildings, number of students, and district location. Our analysis indicated, however, that these factors were not related to the presence of a comprehensive preventive maintenance program.

Among school districts, those with larger amounts of building space were not any more or less likely than those with relatively little square footage to have a comprehensive preventive maintenance program.[2] The same was true when we compared school districts owning older buildings with those owning newer ones.[3]

---

[2] Based on square footage of all school district-owned building space, we divided districts into three groups: small districts with less than 143,356 square feet of space, medium districts with between 143,356 and 321,615 square feet, and large districts with 321,616 or more square feet.

[3] Based on the average age of all school district-owned buildings, we divided districts into three groups: older school district buildings were built in 1959 or earlier; medium-age buildings were built between 1959 and 1973; newer-age buildings were built in 1973 or later.

BEST COPY AVAILABLE

School districts with large numbers of students were not any more or less likely than those with medium or small numbers of students to have a comprehensive preventive maintenance program.[4] Nor was school districts' location within or outside the seven-county Twin Cities metropolitan area related to the presence of comprehensive preventive maintenance.

Similar results were evident among cities and counties. We found that although slightly higher percentages of the larger cities and counties than others had comprehensive preventive maintenance, the relationship was not statistically significant.[5] The same was true when comparing cities and counties located inside the Twin Cities area with those in outstate Minnesota.

Building Conditions in School Districts

We wanted to determine whether the use of comprehensive preventive maintenance was related to the condition of buildings. Although some statewide data exist on the extent of school district buildings' major needs in the coming decade, information on their current conditions was not available. Consequently, we asked school districts to assess the overall condition of their facility components.[6]

As shown in Figure 3.1, 52 percent of school districts reported having most building components in "good" condition as of the 1998-99 school year. We defined "good" as structurally sound building components, with little or no deferred maintenance that allow uninterrupted daily use of facilities. Table 3.1 defines "good," "fair," and "poor" conditions.

School districts with newer buildings were more likely to report having good condition building components.

As might be expected, school districts with relatively newer buildings tended to have most facility components in good condition. About 63 percent of school districts with buildings of an average age of 25 years or newer reported having a majority of building components in good condition. Conversely, about 47 percent of school districts with medium-age buildings and 45 percent of those with older buildings had most components in good condition.

We found a relationship between a comprehensive preventive maintenance program and school facility conditions as reported by school districts.

- **School districts identified as having a comprehensive preventive maintenance program were more likely than others to report having most facility components in good condition.**

---

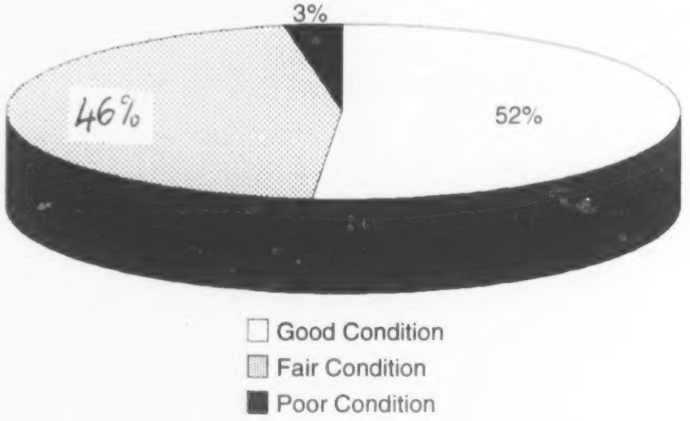
[4] For this analysis, we relied on 1998-99 headcount data provided by the Minnesota Department of Children, Families, and Learning. "Headcount" is defined as the total number of students enrolled in a school district on October 1 of any school year. Based on headcounts of pre-kindergarten through 12th grade students, we divided school districts into three groups: smaller districts had 0 to 663 students, medium districts had 664 to 1,612 students, and larger districts had 1,613 or more students.

[5] For this analysis we divided cities into two groups: large cities had populations of 8,000 or more and small cities had populations less than 8,000. We defined large counties as those with populations of 30,000 or more and small counties as less than 30,000.

[6] Our survey asked school districts to rank the condition of: HVAC systems, plumbing systems, roofs, elevators, electrical and lighting systems, life-safety systems, interior finishes, structural components such as foundations and windows, parking lots and roadways, and grounds, playgrounds, and athletic fields. We did not collect data on the condition of buildings in cities and counties.

More than half of school districts reported having most building components in good condition.

Figure 3.1: School Districts by Condition of Most Building Components,1998-99



SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

About 67 percent of school districts meeting our definition of comprehensive preventive maintenance reported that most of their components were in good condition compared to 47 percent of districts without a comprehensive program.

As Figure 3.1 shows, 46 percent of school districts reported most of their facility components to be in fair condition as of 1998-99; 3 percent of districts reported most of their facility components in poor condition. This may be due to building components nearing the end of their useful life. It may also be due to deferred maintenance, lack of preventive maintenance, or failure to replace components when needed.

Table 3.1: Definitions of Facility Conditions

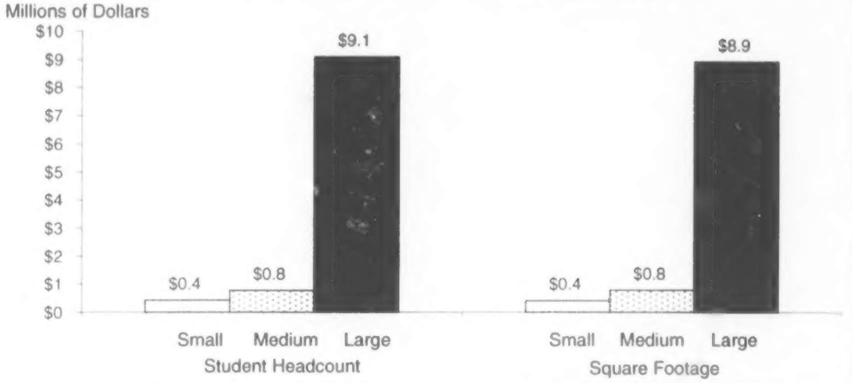
Good	Fair	Poor
Components are structurally sound and require only general maintenance and minor repair; little or no deferred maintenance exists. Few building systems fail, and they allow uninterrupted daily use of the facilities.	Components show signs of slight deterioration and require some corrective maintenance and major repairs; some deferred maintenance exists. Building systems fail occasionally, causing some interruptions in daily use of the facilities.	Components show signs of severe deterioration and require corrective maintenance and emergency repairs; deferred maintenance is extensive. Building systems fail frequently, causing ongoing interruptions in daily use of facilities.

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

Many school districts reported deferring building maintenance due to a lack of resources.

Many school districts around the state have deferred some building maintenance due to lack of resources. In response to the survey, 208 school districts reported some amount of deferred maintenance at the end of the 1998-99 school year, totaling $847 million.[7] The median deferred maintenance was $240,500. The average deferred maintenance was much higher, $3.5 million in 1998-99; the high average amount is due in large part to 13 districts reporting $10 million or more in deferred maintenance. As shown in Figure 3.2, school districts with fewer students and smaller amounts of space reported deferred maintenance amounts that were smaller on the average than districts with more students and larger space. Figure 3.3 shows that school districts with older average-age buildings averaged higher amounts of deferred maintenance than districts with medium-age or newer buildings.

Figure 3.2: Average Deferred Maintenance by School District Headcount and Buildings' Size, 1998-99



NOTE: School districts fell into one of three groups based on headcounts of pre-kindergarten through 12th-grade students: small districts had 0 to 663 students, medium districts had 664 to 1,612 students, and large districts had 1,613 or more students. Based on square footage of all school district-owned building space, small districts had less than 143,356 square feet, medium districts had between 143,356 and 321,615 square feet, and large districts had 321,616 or more square feet.

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

From a January 1999 survey of school districts, the Minnesota Department of Children, Families, and Learning estimated $2.4 billion in capital needs for school district facility repair and replacement tasks to the year 2009. Further, the department estimated this need would exceed available revenues by $1.3 billion.[8] The department's projection did not take into account capital projects in fire and

---

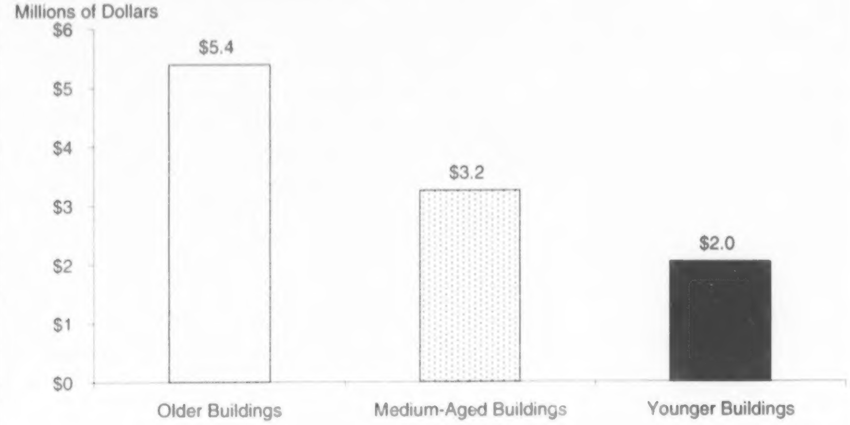
[7] This amount does not represent a statewide total of deferred maintenance because 37 school districts (mostly smaller- to medium-sized districts with a median 1,036 students) did not respond to our survey. In addition, 71 school districts that returned a survey did not answer the question on deferred maintenance. An additional 31 school districts reported $0 in deferred maintenance for 1998-99.

[8] Minnesota Department of Children, Families, and Learning, *Results of the 1999 Facilities Capital Needs Survey* (Roseville, March 1999). The department estimated capital costs of $2.4 billion and revenues of $1.04 billion in combined capital revenues and fund balances through 2009.

BEST COPY AVAILABLE

School districts with older buildings reported higher average deferred maintenance.

Figure 3.3: Average Deferred Maintenance by Average Age of School Buildings, 1998-99



NOTE: School districts fell into one of three groups based on the average age of all school district-owned buildings: older buildings had an average age of 1959 or earlier, medium-aged buildings had an average age between 1959 and 1973, and younger buildings had an average age of 1973 or later.

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

life safety, asbestos abatement, and other health and safety areas because separate funding is available for these projects.[9]

Inadequate school buildings present problems nationwide. A 1996 study by the U.S. General Accounting Office (GAO) stated that about a third of schools around the country reported having at least one entire building in need of extensive repair or replacement.[10] By comparison, the study said that 39 percent of Minnesota schools reported having at least one inadequate building. About 57 percent of schools nationwide, and nearly 57 percent of the Minnesota schools surveyed by the GAO, reported needing extensive repair or overhaul of at least one major building component, such as roofs or plumbing.

Differences in Managing Preventive Maintenance Programs

In some local governments, responsibility for building maintenance rests largely with one office that oversees maintenance for most or all buildings owned by the jurisdiction. This is a centralized approach. In other jurisdictions, one office may oversee building maintenance, but it has responsibility for only a portion of the jurisdiction's buildings. In still others, oversight of building maintenance is "site-based," meaning oversight is lodged at the individual building level; facility

---

[9] A brief description of Health and Safety funding is on page 98 of this chapter.

[10] U.S. General Accounting Office (GAO), *School Facilities: America's Schools Report Differing Conditions* (Washington D.C.: U.S. GAO, June 1996), 32.

BEST COPY AVAILABLE

managers for one building may have little or nothing to do with maintenance decisions elsewhere in the jurisdiction.

- **Most Minnesota school districts reported operating with a districtwide office overseeing building maintenance.**

According to our survey, 81 percent of school districts had a districtwide office responsible for maintenance in 1998-99. In about 15 percent of school districts, responsibility for building maintenance was site-based. The remaining 4 percent of districts reported using a mix of a centralized and site-based approach or some other arrangement. Based on our analysis, school districts with a districtwide office were neither more nor less likely than those with site-based management to have comprehensive preventive maintenance.

We found that:

- **In contrast to school districts, responsibility for building maintenance in cities and counties is often much more decentralized.**

As Table 3.2 shows, 23 percent of cities and counties responding to the survey had one office in charge of maintenance for all buildings owned by the jurisdiction. One-third reported that a central department oversaw maintenance for some, but not all, of the jurisdiction's buildings. Another third reported that each of the jurisdiction's departments was responsible for the buildings it used. The remaining 12 percent used some other oversight arrangement. For example, a small percentage of cities and counties (almost all of which were small cities), reported that the city council or county board retained responsibility for overseeing building maintenance.

Although we noted a pattern between cities' and counties' management arrangement and their likelihood of having comprehensive preventive maintenance, the pattern was not statistically significant. Slightly larger percentages of cities and counties reporting a centralized approach than those reporting decentralized approaches had comprehensive preventive maintenance; but because the number of cases was small the relationship was not significant.

Table 3.2: Oversight of Building Maintenance in Cities and Counties, 1999

	Central Office Oversees All Buildings' Maintenance	Central Office Oversees Some Buildings' Maintenance	Each Department Oversees Maintenance of Buildings It Uses	Other Arrangement
Cities (*N*=243)	26.3%	27.2%	32.5%	14.0%
Counties (*N*=73)	12.3	50.7	32.9	4.1
Total (*N*=316)	23.1	32.6	32.6	11.7

SOURCE: Office of the Legislative Auditor's survey of cities and counties, 1999.

Similarities in Staffing Preventive Maintenance Programs

To perform preventive maintenance, local governments rely both on their own in-house public employees and on private maintenance services hired on a temporary, contract basis. For maintenance and repair that require special equipment or expertise, such as ultrasonic noise testing to identify arcing in electrical equipment, local jurisdictions often turn to private firms instead of retaining those tools or skills on staff. They also contract for services when they find it inefficient to employ full-time personnel for infrequent tasks or when they need additional help for special projects or maintenance backlogs.

Cities and counties were more likely than school districts to perform most preventive maintenance with in-house labor.

We asked local governments about their use of in-house personnel and contracted labor for preventive maintenance. From the surveys we found:

- **Overall, most school districts, cities, and counties (420 out of 496 jurisdictions) that actively perform preventive maintenance reported using a mix of in-house staff and contracted labor for preventive maintenance.**

Far fewer jurisdictions relied almost exclusively on in-house staff for preventive maintenance and fewer still relied almost exclusively on contracted labor. Table 3.3 illustrates the differences. Virtually all school districts actively performing preventive maintenance used a combination of in-house and contracted labor for preventive maintenance in 1998-99.

Cities and counties were more likely than school districts to rely on in-house staff for most or all preventive maintenance: About a quarter of cities and counties actively performing preventive maintenance used in-house staff for most or all preventive maintenance, compared to less than 1 percent of school districts. Only cities appeared to have a substantial number (11 percent of city respondents) that relied on contracted labor for most or all preventive maintenance.

Table 3.3: Staffing for Preventive Maintenance in Local Governments, 1999[a]

	Combination of In-House and Contracted Staff for Most or All Preventive Maintenance	In-House Staff for Most or All Preventive Maintenance	Contracted Labor for Most or All Preventive Maintenance
School Districts (*N*=292)	97.3%	0.7%	1.4%
Cities (*N*=149)	64.4	23.5	10.7
Counties (*N*=55)	72.7	27.3	0.0

[a] Includes only local jurisdictions indicating they actively performed preventive maintenance.

NOTE: Rows may not total to 100% because some respondents marked other staffing arrangements.

SOURCE: Office of the Legislative Auditor's surveys of school districts and of cities and counties, 1999.

We looked for but did not find statistically significant relationships between the presence of comprehensive preventive maintenance and the type of staffing arrangement. Comprehensive preventive maintenance did not appear related to whether jurisdictions used a mix of in-house and contracted labor, relied on in-house labor, or relied on contracted labor for most preventive maintenance.

OBSTACLES LIMITING PREVENTIVE MAINTENANCE

While many school districts, cities, and counties reported providing at least minimal preventive maintenance, 76 percent of school districts, and 67 percent of cities and counties, indicated that certain obstacles limited their ability to perform such maintenance. The obstacles may help explain why few local governments have comprehensive preventive maintenance, as reported earlier.

Many local jurisdictions said that there were very serious funding obstacles limiting the amount of preventive maintenance they can do.

We asked local jurisdictions to indicate how serious the obstacles were in limiting their preventive maintenance. Overall, the obstacles listed most frequently as very serious were those related to inadequate funding for building maintenance. As Figure 3.4 shows, these funding-related obstacles were: competition for limited dollars, insufficient staff hours available for the work, state-imposed levy limits, funding restrictions that dissuade spending on preventive maintenance, and increased maintenance needs due to new construction.

Table 3.4 lists the obstacles to preventive maintenance, as reported by local jurisdictions. This table shows that higher percentages of school districts than cities and counties identified factors pertinent to funding as very serious obstacles to preventive maintenance. As described in the following sections, the level of seriousness for some obstacles varied among school district superintendents, business officers, and facility managers.

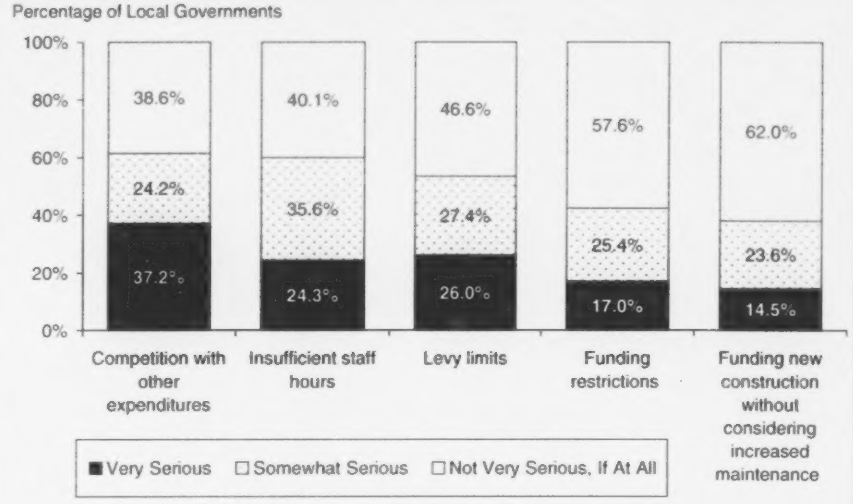
Competition for Limited Dollars

School districts, cities, and counties most frequently cited competition for limited dollars as a very serious obstacle. According to the surveys:

- **41 percent of school districts, and 34 percent of cities and counties, reported that competition with other expenditures for limited dollars was a very serious obstacle to preventive maintenance.**

Among school districts, a higher proportion of Twin Cities area districts than outstate districts, approximately 62 and 37 percent respectively, reported this obstacle as very serious. On the other hand, more outstate cities and counties (approximately 39 percent) than Twin Cities area cities and counties (approximately 21 percent) reported this obstacle as very serious.

Figure 3.4: Seriousness of Funding-Related Obstacles to Preventive Maintenance, 1999



SOURCE: Office of the Legislative Auditor's surveys of school districts and cities and counties, 1999.

Insufficient Staff Hours

Another funding-related obstacle rated by many jurisdictions as very serious was insufficient maintenance staff hours for the necessary work. We found that:

- **30 percent of school districts, and 18 percent of cities and counties, reported that having insufficient staff hours available for the necessary work was a very serious obstacle to preventive maintenance.**

Among school districts, a higher percentage of facility managers than superintendents or business officers cited insufficient staff as a very serious obstacle: 42 percent of facility managers, compared to 22 percent of superintendents and 27 percent of business officers, reported this as a very serious obstacle.

School districts' most common noninstructional budget cuts for 2000 were planned for custodial, maintenance, or grounds activities.

Insufficient maintenance staff hours may reflect school district budget cuts. A recent report from the Office of the Legislative Auditor found that the most common noninstructional budget cuts Minnesota school districts planned for 2000 were to custodial, maintenance, or grounds activities.[11] When public school superintendents were asked to list their five largest noninstructional budget cuts for 2000, the largest group, 12 percent, reported making budget cuts in this area. Among instructional budget cuts, only two items met or exceeded the frequency of custodial and maintenance cuts: 27 percent of superintendents reported cuts in

---

[11] Office of the Legislative Auditor, *School District Finances* (St. Paul, February 2000), 69-70.

Table 3.4: Obstacles to Performing Preventive Maintenance, 1999

Obstacle	Very Serious		Somewhat Serious		Not Very Serious, If At All[a]	
	Schools	Cities and Counties	Schools	Cities and Counties	Schools	Cities and Counties
Competition with other local expenditures for limited dollars (*N*=296 schools and 295 cities and counties)	40.5%	33.9%	27.0%	21.4%	32.4%	44.7%
Not enough staff hours available for the necessary work (*N*=296 schools and 297 cities and counties)	30.4	18.2	39.2	32.0	30.4	49.8
Limits imposed by the state on the property taxes local jurisdictions may levy (*N*=295 schools and 289 cities and counties)	28.1	23.9	35.3	19.4	36.6	56.7
Funding restrictions that dissuade spending on preventive maintenance (*N*=288 schools and 264 cities and counties)	23.6	9.8	31.9	18.2	44.4	72.0
Funding new construction without considering resulting increased maintenance needs (*N*=291 schools and 290 cities and counties)	16.5	12.4	25.8	21.4	57.7	66.2
Labor shortages in the region (*N*=292 schools and 289 cities and counties)	12.7	4.8	29.1	18.0	58.2	77.2
Numerous emergency or unscheduled major repairs that preclude preventive maintenance (*N*=296 schools and 283 cities and counties)	10.5	3.5	38.5	19.8	51.0	76.7
Decision makers have not made preventive maintenance a high priority (*N*=291 schools and 292 cities and counties)	8.9	11.6	29.2	27.1	61.9	61.3
Federal, state, or local requirements related to maintaining buildings or planning their maintenance[b] (*N*=285 schools and 259 cities and counties)	8.4	1.5	25.6	10.8	66.0	87.6
Too little training or expertise to implement preventive maintenance (*N*=296 schools and 291 counties and cities)	6.1	5.8	43.2	25.4	50.7	68.7
Difficulty hiring contracted maintenance services during the traditional three-month summer break[c] (*N*=294 schools)	5.4	N/A	30.3	N/A	64.3	N/A
Inexperience presenting building maintenance information to policy makers (*N*=292 schools and 285 cities and counties)	1.7	4.2	21.2	18.2	77.1	77.5

[a] Responses include those indicating they have not encountered obstacles to preventive maintenance.

[b] Respondents' written comments cited examples of the fire code, Americans with Disabilities Act, state building code, and OSHA, among other requirements. Two respondents reported that these requirements help justify maintenance funding.

[c] We asked this question of school districts only.

SOURCE: Office of the Legislative Auditor's surveys of school districts and cities and counties, 1999.

BEST COPY AVAILABLE

regular teaching positions, and 12 percent reported cuts in expenditures for teachers' aides.

A second factor that may contribute to insufficient available staff hours is regional labor shortages. As shown in Table 3.4, about 13 percent of school districts and 5 percent of cities and counties cited labor shortages in the region as a very serious obstacle to performing preventive maintenance.

Levy Limits

A third obstacle related to funding preventive maintenance was levy limits. Although local jurisdictions have authority to levy property taxes for operations that include maintenance, state statutes restrict the amounts of property taxes that are levied.[12] Counties and most cities may not increase their levies above prescribed limits, and school district levies are largely set by the state.

- **Approximately 24 percent of cities and counties reported that levy limits preventing them from increasing their tax levies created very serious obstacles to performing preventive maintenance. A higher percentage of counties than cities, approximately 34 and 21 percent respectively, cited levy limits as a very serious obstacle.**

School districts also indicated levy limits restricted their ability to perform preventive maintenance. State limits apply not only to school districts' general education levies, but also to the referendum revenue program (described later in this chapter) which requires voter approval.[13] According to the survey:

- **28 percent of school districts reported that limits imposed by the state on the property taxes they levy are very serious obstacles to performing preventive maintenance.**

While some local jurisdictions view levy limits as an obstacle, others face taxpayer resistance to levying their full authorized amounts. Several cities and counties explained in written comments on the survey that pressure from taxpayers or already high property taxes have made it difficult to seek additional taxpayer revenue. Some school districts cited lack of taxpayer support for referenda as an obstacle.

Funding Restrictions

Regarding another funding-related obstacle, school districts, cities, and counties reported that funding restrictions dissuading spending on preventive maintenance limited their ability to perform preventive maintenance. According to the surveys:

- **24 percent of school districts, and 10 percent of cities and counties, cited funding restrictions that dissuade spending on preventive maintenance as a very serious obstacle.**

---

[12] *Minn. Stat.* §§275.70-275.74; 126C.13.

[13] *Minn. Stat.* §126C.17. This program is sometimes referred to as the excess levy referendum.

In their written comments to this survey question, local jurisdictions offered examples of funding restrictions, some of which overlapped other obstacles. For example, several school district respondents indicated that the state should establish categorical maintenance funding or that preventive maintenance suffers from competition with other uses of operating capital revenue—also connected to the obstacle on competition for limited dollars. A number of districts wrote that insufficient budgets restricted their ability to perform preventive maintenance.

In written comments on the survey, city and county examples of financing restrictions included: insufficient budgets; taxpayer pressure, a small property tax base, or high property taxes that make it difficult to seek additional funding from taxpayers; and constraints on their ability to bond for maintenance and repairs or decision makers' unwillingness to bond.

Increased Maintenance Needs Due to New Construction

Adding building square footage or more sophisticated building systems can increase the need for both maintenance person hours and advanced technical skills. Because new construction often receives more attention than ongoing building maintenance, local jurisdictions may find it difficult to draw adequate attention to maintenance needs.[14]

Although new construction may increase maintenance needs, the needs are not always considered in advance.

- **Nearly 17 percent of school districts, and 12 percent of cities and counties, cited decision makers' approval to fund new construction without considering the resulting increased maintenance needs as a very serious obstacle to preventive maintenance.**

This suggests that these survey respondents believe decision makers do not place a sufficiently high priority on increased maintenance needs when funding new construction. Facility managers were more likely than other school district respondents to report funding new construction without considering increased maintenance needs as a very serious obstacle to preventive maintenance. Approximately 28 percent of facility managers, 15 percent of business officers, and 4 percent of superintendents cited this as a very serious obstacle.

Preventive Maintenance Not a High Priority

Some survey respondents indicated that their local decision makers have not made preventive maintenance a high priority. Although more cities and counties than school districts cited this obstacle as very serious, it was the sixth most frequently cited overall. According to the surveys:

- **9 percent of school districts, and 12 percent of cities and counties, reported that local decision makers' failure to make preventive maintenance a high priority was a very serious obstacle.**

---

[14] American Public Works Association (APWA) and Building Research Board of the National Research Council, *Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings* (Chicago: APWA, 1991), 1.

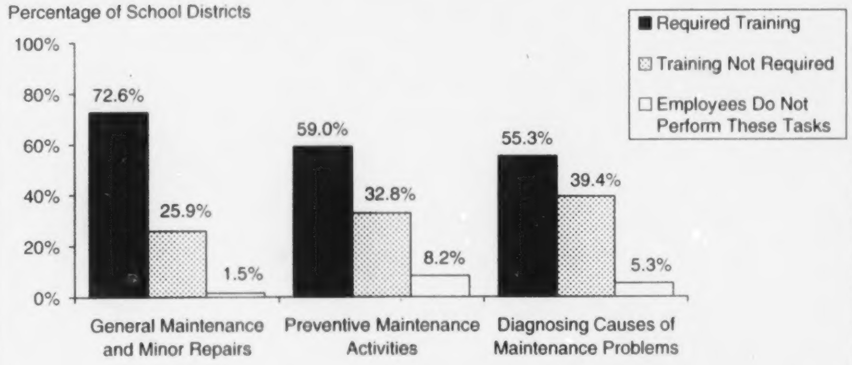
Among school districts, facility managers were more likely than other respondents to report this as a very serious obstacle: 16 percent of facility managers, 2 percent of superintendents, and no business officers cited this as a very serious obstacle limiting their district's ability to perform preventive maintenance. A few cities, counties, and school districts wrote in comments on the survey that local decision makers' short-term outlook regarding building needs was an obstacle.

Lack of Training or Public-Speaking Experience in School Districts

While only 6 percent of school districts identified lack of training or expertise as a very serious obstacle to preventive maintenance, and 43 percent identified it as somewhat serious, we found that most of these same districts required preventive maintenance training for their workers. This suggests that the training may be inadequate to meet these districts' needs for preventive maintenance. As Figure 3.5 shows, of the 134 school districts citing lack of training as a very serious or somewhat serious obstacle to preventive maintenance, 59 percent reported that they required preventive maintenance training for employees expected to perform that maintenance. In addition, about 55 percent of these same districts reported requiring training on diagnosing the causes of maintenance problems, and about 73 percent reported requiring training on general maintenance and repairs.

At the same time, for school districts indicating that inexperience making public presentations was an obstacle, lack of public-presentation training may be a factor. Fairly small percentages of school district respondents reported that inexperience presenting building information to school boards posed an obstacle to preventive maintenance. Most of these districts, however, did not require

Figure 3.5: Maintenance Training Required by School Districts Reporting Lack of Training as an Obstacle to Preventive Maintenance, 1998-1999



NOTE: 49 percent of school district respondents reported lack of training as an obstacle; 18 districts (6 percent) considered it a very serious obstacle, and 128 districts (43 percent) reported it as somewhat serious; 134 of the 146 districts answered questions on required training.

SOURCE: Office of the Legislative Auditor's survey of school districts, 1999.

training in public presentation skills, according to the survey. Of 61 school districts indicating lack of public speaking experience as a very serious or somewhat serious obstacle to preventive maintenance, only 5 percent reported they required training in public presentation skills of employees expected to make presentations. Another 57 percent reported the district did not require such training of those expected to make public presentations; the remainder said that maintenance employees do not make presentations.

FUNDING PREVENTIVE MAINTENANCE

Because preventive maintenance includes daily maintenance, minor repairs, and major system replacement, local governments rely on both operating and capital funds to cover preventive maintenance expenses. Funding arrangements differ, however, between cities and counties on the one hand and school districts on the other.

City and County Funding

Cities and counties are responsible for funding preventive maintenance for their buildings and generally must pay for it with local revenue sources. Most cities and counties rely on property taxes and other general fund revenues (which may include state aid) for their building maintenance expenses. As reported earlier, state statutes limit the amounts most local governments can levy each year.[15]

Cities and counties rely largely on local revenues to fund preventive maintenance.

In addition to other tax authority, counties have explicit authority to levy an amount each year specifically for a county building fund.[16] They may use these levy proceeds for acquiring, constructing, maintaining, or repairing buildings used in the administration of county affairs. According to the survey:

- **47 percent of counties (24 counties) actively performing preventive maintenance indicated they consistently levied taxes for a county building fund.**

About 65 percent of larger counties (13 of 20 counties) used a county building fund, compared with 36 percent of smaller counties (11 of 31 counties).

To finance capital expenditures for the betterment of their buildings (such as repairs or reconstruction), cities and counties have authority to sell bonds and increase their property tax levy to pay for the bonds over time.[17] For such levies, a majority of the jurisdictions' voters must first approve the bond sale in a referendum.[18] Jurisdictions cannot exceed specified debt limits for the sale of bonds.[19] Few cities and counties that actively perform preventive maintenance, approximately 5 percent (9 jurisdictions), reported that they consistently issue bonds to raise funds for major preventive maintenance projects.

---

[15] *Minn. Stat.* §275.71.

[16] *Minn. Stat.* §373.25.

[17] *Minn. Stat.* §475.52, subd. 1, 3.

[18] *Minn. Stat.* §475.58, subd. 1.

Counties have an option of bypassing voter approval for capital improvements by submitting a qualifying capital improvement plan to the Minnesota Department of Trade and Economic Development.[20] The plan must meet several state requirements.[21] With department approval of the plan, a county can issue the capital improvement bonds unless 5 percent of local voters submit a qualifying petition requesting a vote.

School District Funding

In contrast to cities and counties, school districts and the state share responsibility for funding schools, including building maintenance. Under the state's current school financing program, general education revenue is the primary source of operating funds for school districts.[22] School districts receive general education revenue from local property taxes and state aid payments based on an equalized formula that provides for the same amount of revenues per pupil unit and the same tax effort for each district. School boards may use general fund dollars for maintenance expenses, including preventive maintenance.

School districts and the state share funding responsibilities for preventive maintenance.

Operating Capital Revenue

General education revenue comprises nine components, one of which is operating capital revenue.[23] Operating capital is a reserved account within school districts' general funds.[24]

State statutes specify eligible uses of operating capital revenue. School districts may use operating capital revenue for building construction, removal of asbestos, fire code compliance, and building improvements and repairs including preventive maintenance. They may also spend it, however, on other "nonbuilding"

---

[19] *Minn. Stat.* §475.53, subd. 1, 3. Generally, no municipality shall incur a net debt in excess of 2 percent of the market value of taxable property in the municipality. If its charter permits, a city of the first class may incur debt up to 3-2/3 of its valuation.

[20] *Minn. Stat.* §373.40. Building improvements must have an expected useful life of at least five years. Counties must not exceed debt limits specified in statute.

[21] The plan must set forth, among other items, the estimated schedule, annual costs, and details of specific capital improvements over a five-year period, as well as the need for the improvements and the sources of revenues. In preparing the plan, the county must also consider alternatives for providing services more efficiently through shared facilities with other local governments.

[22] Minnesota House of Representatives Research Department, *Minnesota School Finance: A Guide for Legislators* (St. Paul, December 1998), 20.

[23] The nine components are: Basic Revenue, Basic Skills Revenue (including Compensatory Revenue), Operating Sparsity Revenue, Transportation Sparsity Revenue, Operating Capital Revenue, Graduation Rule Revenue, Training and Experience Revenue, Supplemental Revenue, and Transition Revenue.

[24] Operating capital revenue is based in part on a combination of a former equipment formula and a former facilities formula. The 1996 Legislature combined the former equipment revenue and facilities revenue into operating capital revenue and moved the account into the general fund. *Minn. Laws*, (1996), ch. 412, art. 1, sec. 32.

BEST COPY AVAILABLE

expenses.[25] Other eligible purchases are textbooks, library books, vehicles, computers, and personnel costs for buying and maintaining computers and telecommunications systems.

School districts can spend "operating capital" on textbooks and computers, as well as on buildings.

Although state statutes do not prohibit school boards from reserving revenue for preventive maintenance (beyond operating capital revenues), it is not a common practice. As reported in Chapter 2, among the school districts that actively perform preventive maintenance, only 9 percent (24 districts) reported that they consistently use reserved accounts (other than operating capital reserves) to fund preventive maintenance.

Referenda for Operating and Capital Expenditures

With the approval of voters, school districts can raise referendum revenue for additional operating dollars, including for maintenance.[26] The state provides some aid to equalize a portion of school district referendum levies but also limits the amount of money districts may raise through these "excess" levies.

Similar to cities and counties, school districts have authority to issue bonds to pay for capital improvements to school facilities.[27] Before school districts issue bonds, a majority of the districts' voters must approve the bond sale in a referendum.

Additional Funding Sources for School District Maintenance

School districts may obtain additional revenue through four programs that could involve preventive maintenance projects. Requirements vary by program, as described below.

Health and Safety Revenue

School districts may levy property taxes and receive state aid for Health and Safety Revenue.[28] To qualify, districts must have a health and safety program that includes the estimated annual repair and replacement costs for each building in the district.[29] They must also receive approval for their projects from the Department of Children, Families, and Learning.

Disabled Access and Fire Safety Revenue

With approval from the commissioner of the Department of Children, Families, and Learning, districts may levy taxes to cover the costs of making school buildings accessible to students or staff with handicaps or to make fire-safety improvements.[30] These funds allow for limited preventive maintenance activities. For instance, school districts can use the revenues to pay for inspections related to the fire code, but not for boiler inspections. Regardless of school district size or facility needs, the state limits district levies for these projects to a total $300,000 over a period of up to 8 years.

---

[25] *Minn. Stat.* §126C.10, subd. 14.

[26] *Minn. Stat.* §126C.17.

[27] *Minn. Stat.* §475.52, subd. 5. *Minn. Stat.* §475.53, subd. 4 restricts the amount of such debt a school district may incur to 10 percent of the district's taxable properties' market value. Further, subdivision 5 of this statute prohibits the St. Paul and Duluth school districts from issuing bonds for terms of more than two years if their aggregate outstanding debt is more than 0.7 percent of their taxable properties' market value.

[28] *Minn. Stat.* §123B.57.

[29] Generally, qualifying projects include those necessary to: (a) correct fire, safety, or health hazards, (b) remove and manage asbestos and hazardous chemicals, (c) perform repairs related to storing fuel or oil, or (d) perform health, safety, and environmental management, including monitoring and improving indoor air quality.

Alternative Facilities Bonding and Levy

Under the Alternative Facilities Bonding and Levy Program, qualifying school districts may levy taxes or issue general obligation bonds for capital improvements, including maintenance and repairs.[31] Districts need not hold a referendum but must receive approval of the school board and commissioner. To qualify, school districts must meet minimum statutory thresholds for student population and square footage. They must also have: a 10-year facility plan with an inventory of projects and costs; an average-building age of 15 years or more; and insufficient funds either for deferred maintenance or to make fire, safety, or health repairs. Because this revenue is targeted at school districts with large amounts of square footage, only 14 school districts are currently eligible to apply.[32]

Very few school districts qualify for Alternative Facilities Bonding.

Bonds for Certain Capital Facilities

School districts can issue general obligation bonds to finance repairs and improvements to school sites and buildings with approval from the commissioner.[33] School districts may also use the bond proceeds for projects related to disabled access and fire and life-safety code compliance. Voter approval is unnecessary if the commissioner approves the capital project and voters decline to file a qualifying petition demanding a referendum. School districts rarely use this process to fund capital projects, according to the Department of Children, Families, and Learning. Some school officials indicate this is not a viable financing option because it does not grant additional debt and levy authority; instead, districts must pay for the general obligation bonds within their allowed general education levy amounts.[34] According to the department, another reason may be that the process excludes voters from the decision-making process.[35]

---

[30] *Minn. Stat.* §123B.58; *Minn. Laws* (1999), ch. 241, art. 4, sec. 29, para. (b) repeals this program in 2004. School districts qualify only if they have insufficient money in their operating capital fund for these projects.

[31] *Minn. Stat.* §123B.59. School districts participating in the Alternative Facilities Bonding and Levy Program may not use Health and Safety Revenue for capital projects funded by the Alternative Facilities program.

[32] The 14 school districts are: Anoka-Hennepin, Bloomington, Burnsville, Duluth, Minneapolis, North St. Paul, Osseo, Robbinsdale, Rochester, Rosemount-Apple Valley-Eagan, St. Cloud, St. Paul, South Washington County, and Stillwater.

[33] *Minn. Stat.* §123B.62.

[34] *Minn. Stat.* §123B.62, (d).

[35] Norm Chaffee, Coordinator, Department of Children, Families, & Learning, Division of Management Assistance, Telephone interview by author, St. Paul, January 31, 2000.

LAWS AND RULES AFFECTING LOCAL GOVERNMENTS' PREVENTIVE MAINTENANCE

State and federal requirements affect how local governments operate maintenance programs. Many of these requirements pertain to maintenance employee training and maintenance operations. In this report, we do not present a comprehensive list of the many regulations affecting building maintenance; the requirements below illustrate only a range of activities affected by federal and state statutes.

U.S. Environmental Protection Agency

School districts must follow asbestos management practices.

Federal laws mandate that local governments perform certain maintenance-related activities. For example, the U.S. Environmental Protection Agency requires school districts to establish procedures for identifying and remedying unreasonable risks posed by asbestos-containing material in elementary and secondary school buildings.[36] These regulations include training school maintenance employees working in asbestos-containing buildings, as well as keeping comprehensive records of asbestos-related maintenance activities.[37]

Minnesota Occupational Safety and Health Act (MNOSHA)

MNOSHA sets standards for workplace health and safety, including rules pertaining to training for maintenance workers. Because Minnesota has adopted by reference the federal occupational safety and health standards, the U.S. OSHA regulations also apply.[38] To minimize the risk of injury to employees, many rules require that workers receive training before undertaking specific activities or working in affected environments. For instance, MNOSHA training requirements pertain to conserving hearing, working in confined spaces, and using hazardous chemicals or harmful physical agents, such as cleaning chemicals and sprays.[39]

We observed that most school districts require OSHA-related training for their employees.[40] According to our survey,

- **96 percent of school districts required OSHA-related training for applicable maintenance employees.**

---

[36] *40 CFR* sec. 763.80 (1998). Under this rule, school districts must maintain and update asbestos management plans, reinspect their buildings once every three years, ensure custodial and maintenance personnel receive awareness training, and inform workers and building occupants about asbestos-related activities at least once annually. See *40 CFR* secs. 763.93 (1998); 763.85(b) (1998); 763.92(a) (1998); 763.93 (e)(10) (1998).

[37] *29 CFR* secs. 1910.763.929(a) (1998); 1910.763.94 (1998).

[38] *Minn. Rules*, ch. 5205.0010, subp. 1, 2.

[39] *29 CFR* sec. 1910.959(c) (1998); *29 CFR* sec. 1910.95(k)(3) (1998); *29 CFR* sec. 1910.1200, (h)(1) (1998); and *Minn. Rules*, ch. 5207.0302, subp. 6.

[40] Similar data were not available for cities and counties.

Another 1 percent of school districts reported that their employees do not perform tasks related to OSHA requirements.

OSHA requirements affect maintenance training and operations.

Some MNOSHA rules pertain to operating procedures. For example, MNOSHA requires employers to develop an energy control program to minimize injuries from unexpected startups of machines while employees are maintaining them. The program must include procedures to lock out or "tag out" machines and control energy sources.[41]

Other rules apply to protective equipment and building maintenance objectives. As an example, all maintenance personnel must have and use protective equipment whenever their work involves activities capable of causing injury or impairment, including exposure to chemical hazards or mechanical irritants.[42] In addition, employers must assure proper maintenance and repair of buildings and their components to keep them in safe operating condition and free from hazards, such as falling bricks or glass.[43]

State Fire Code

The State Fire Marshal enforces the *Minnesota Uniform Fire Code* and conducts inspections of buildings and their life-safety components. Minnesota's fire code applies to buildings throughout the state.[44] For schools in particular, the 1990 Legislature established an inspection program whereby the State Fire Marshal inspects all public schools at least once every three years.[45] Certain fire code provisions pertain to maintaining fire-protection systems. For instance, cities, counties, and school districts must ensure their automatic fire extinguishing systems are inspected and tested at least annually.[46]

Department of Children, Families, and Learning

School districts intending to construct, remodel, or improve their buildings at estimated costs greater than $100,000 must first consult with the Department of Children, Families, and Learning prior to holding a referendum for bonds or using operating capital revenues.[47] For large projects requiring expenditures greater than $400,000, school districts must submit a proposal for review and comment by the department.[48] The commissioner reviews the proposed projects' educational and economic advisability. A "positive" review means a district can proceed with the project. An "unfavorable" review requires the school board to reconsider the project and proceed only if 60 percent of voters approve. A "negative" review means the school board must further consult with the commissioner and, if necessary, obtain approval from an administrative law judge to proceed.

---

[41] *29 CFR* sec. 1910.147(c) (1998).

[42] *29 CFR* sec. 1910.132(a) (1998).

[43] *Minn. Rules*, ch. 5205.0660, subp. 1, 2.

[44] *Minn. Stat.* §299F.011, subd. 4.

[45] *Minn. Stat.* §123B.73, subd. 1. The State Fire Marshal began a second round of inspections in mid-1999, with a focus on code violations due to failure to perform proper maintenance on buildings and fire- and life-safety systems.

[46] International Fire Code Institute, *1997 Uniform Fire Code Volume 1* (Whittier, CA: International Fire Code Institute, 1997), part 3, art. 10, sec. 1001.5.2.

[47] *Minn. Stat.* §123B.71, subd 1.

Department of Corrections

The Minnesota Department of Corrections is responsible for overseeing and licensing local jails, lockups, and detention facilities for juvenile and adult offenders.[49] Cities and counties must operate these facilities in accordance with department standards for management and physical condition of buildings, as well as the security, safety, and health of inmates.[50] Facility administrators must have policies and procedures to detect building and equipment deterioration, develop a written maintenance plan, have a system of prioritizing work requests, maintain records of repairs, and document resource requests for repairs or equipment replacement.[51]

At least once every biennium, Department of Corrections employees review county housekeeping, sanitation, and plant maintenance practices of local detention facilities. County sheriffs and local boards of health must, on behalf of the department, inspect city lockups for compliance with these rules.[52]

When cities and counties have repair plans exceeding $5,000 for detention facilities and lock-ups, they must transmit the proposal to the Department of Corrections for advice and suggestions on managing and funding the project.[53] In the interest of maintaining public safety, the repair plans must meet department standards.[54] The Department of Corrections reviews the plans to determine whether the proposed repair affects secured areas of a facility, either by interfering with design intent or altering the original use of a system or building component.[55] For all projects, regardless of cost, the department requires the local jurisdiction to maintain records of repairs and costs.

---

[48] *Minn. Stat.* §123B.71, subd. 8. Upon written request, the commissioner may exempt a project from review if the district funds it from General Education or Health and Safety revenues. School districts must submit various data about the proposal including construction details, the number of people to be served, effect of the project on the district's operating budget, and indoor air quality considerations. See *Minn. Stat.* §123B.71, subd. 9-10.

[49] *Minn. Stat.* §241.021, subd. 1.

[50] *Ibid.*

[51] *Minn. Rules*, ch. 2911.7200, subp. 4, 5; ch. 2911.7400; ch. 2945.5490, subp. 2, 5, 7, 8.

[52] *Minn. Stat.* §642.09. The commissioner of corrections may condemn city lockups and county jails that fail to reasonably conform to department standards and endanger the health and safety of their occupants. See *Minn. Stat.* §§641.26; 642.10.

[53] *Minn. Stat.* §§641.21; 642.01. In the case of repairs to lock-ups, the commissioner's approval is required.

[54] *Minn. Stat.* §642.02, subd. 1.

[55] Dennis Falenschek, Director, Minnesota Department of Corrections Facilities Inspection and Enforcement Division, Telephone interview by author, St. Paul, Minnesota, January 26, 2000.

Other State Requirements

The state regulates boiler operations and requires licensure of operators.

State regulations affect local government maintenance of specific building systems. For instance, the state building code governs building construction and remodeling. Its requirements affect accessibility, electricity, energy, fire protection, plumbing, and mechanical components, such as elevators.

Some state statutes apply to licensure and training for specific building equipment. As an example, Minnesota requires inspections of boilers, either annually or biannually depending on the size and type of boiler.[56] Licensed and qualified personnel must operate and maintain boilers according to state rules.[57]

---

[56] *Minn. Stat.* §§183.42; 183.45.

[57] *Minn. Rules*, ch. 5225.0400; and *Minn. Stat.* §183.502. State requirements include minimum standards for on-site attendance, frequency of monitoring, repairs or alterations, and keeping records of maintenance activities. See *Minn. Rules*, ch. 5225.1140; ch. 5225.1180; ch. 5225.2600.

Study Methodology

APPENDIX A

This appendix explains the process we followed to conduct the best practices review of preventive maintenance for local government buildings. It describes the steps we took, the timeline we followed, and the involvement of local and state government representatives, professional associations, and the private sector.

BACKGROUND RESEARCH

To explore issues relevant to preventive maintenance, we gathered information from a variety of sources. We began with an extensive literature review of materials from professional associations and other groups with expertise in preventive maintenance, such as the American Public Works Association, Association of School Business Officials International, Building Owners and Managers Association, International Facilities Management Association, and U.S. Army Corps of Engineers. We also researched state and federal laws to learn about legal requirements relevant to building maintenance and funding.

At the beginning of the study in June 1999, we held a roundtable discussion to help define the scope of the review. We invited individuals representing a variety of viewpoints to participate, including administrators and facility managers from school districts, cities, and counties; state legislators and legislative staff; and others interested in preventive maintenance services. At this meeting, 26 participants, in addition to Legislative Auditor's Office staff, presented ideas for topics to include in the review.

We supplemented our literature review and roundtable discussion with personal interviews. Discussions with facility managers and finance directors in several Minnesota school districts, cities, and counties provided additional information about preventive maintenance practices and obstacles to performing preventive maintenance. We met with individuals from private sector building-maintenance firms for additional background on available services and recommended practices.

A technical advisory panel offered expertise on preventive maintenance.

TECHNICAL ADVISORY PANEL

Early in the project we formed a technical advisory panel to provide expertise and comment on draft materials throughout the review. The 11-member panel consisted of maintenance professionals and others involved with funding or providing preventive maintenance. Members represented school districts, cities, counties, the private sector, and the Department of Children, Families, and Learning. They came from a variety of sizes of jurisdictions and regions of the state. Table A.1 lists the individuals who served on our technical panel.

We are grateful to the panel members for their advice and help. It is important to note that panel members may or may not agree with the recommendations of our study; the Legislative Auditor's Office remains responsible for the report's contents.

Table A.1: Technical Advisory Panel Members, 1999-2000

Phil Allmon, Management Analyst, Department of Children, Families, and Learning
Woody Franklin, Director of Facilities, Eden Prairie Public Schools
Eugene George, Supervisor of Buildings and Grounds, Minnetonka Public Schools
Noel Graczyk, Administrative Services Director, City of Chaska
Fred King, Director of Business Development, INSPEC, Inc.
Tony Mancuso, Director of Property Management, St. Louis County
Len Nachman, Educational Planner, SGN Architects
Dave Nelson, Real Estate Manager, City of St. Paul
Steve Nystedt, Director of Facilities Management, Dakota County
Jim Thorne, Business Manager, Delano Public Schools
Dale Winch, Director of Property Management, Anoka County

NOTE: Title indicates the person's position as our study began.

PERFORMANCE MEASURES FOR PREVENTIVE MAINTENANCE

To help identify effective and efficient preventive maintenance practices, we researched guidelines recommended by organizations in the building construction and maintenance industries and standards required by law. Based on this research, we compiled performance measures related to effective planning and use of preventive maintenance. In September 1999, we met with our technical advisory panel to review the measures of performance and later modified some based on the panel's feedback.

These performance measures formed the basis of questions we developed to survey local governments on their preventive maintenance practices (the surveys are discussed below). We used the performance measures to compare local jurisdictions' involvement with preventive maintenance and to identify those reporting effective and efficient practices. The best practices for successful preventive maintenance discussed in Chapter 2 also evolved from the performance measures. In November 1999 we met with our technical panel to discuss these practices, and modified them accordingly.

SURVEY METHODOLOGY

We surveyed school districts, cities, and counties to gather information on the degree to which local jurisdictions use preventive maintenance practices, to identify jurisdictions using those practices effectively, and to determine obstacles to preventive maintenance. Our surveys asked local jurisdictions about their maintenance operations, personnel, planning, and funding. School districts were asked specifically about the 1998-99 school year. The questions came from preventive maintenance performance standards compiled earlier in our study. Our intent was to collect information on how frequently local jurisdictions met the standards.

We developed separate surveys for school districts, cities, and counties. While the city and county surveys were nearly identical, the school district survey was much longer. Because of particular legislative interest in school district buildings, our school district survey included more questions than our surveys of cities and counties. Before mailing the surveys, we pretested survey questions with our technical advisory panel in September and October 1999.

Tables A.2 through A.4 list the local jurisdictions receiving our surveys and denote which jurisdictions responded. Copies of the survey instruments and their aggregate results are available on our web site at http://www.auditor.leg.state.mn.us/ped/2000/pe0006.htm or by contacting project manager Jody Hauer at 651/296-8501 or jody.hauer@state.mn.us.

City and County Surveys

About 83 percent of cities and counties responded to the survey.

In early October 1999, we mailed county surveys to either facility managers, county engineers, or county administrators in all 87 counties. We sent city surveys to all 96 cities with a population of 8,000 or more and to a stratified random sample of 200 smaller cities. The city surveys went to the city managers, administrators, or clerk-treasurers in our sample.[1] To ensure our sample of cities represented all geographic regions in the state, we grouped these small cities according to the 13 economic development regions and, for each region, randomly selected a percentage of cities based on that region's proportion of the state population.

The deadline for completing the surveys was October 20, 1999. We mailed follow-up letters and surveys to cities and counties that had not responded by the first due date, and extended the deadline to early November.

We received surveys in time for analysis from 73 of the 87 counties, for a county response rate of 83.9 percent, and from 246 of the 296 cities surveyed, for a city response rate of 83.1 percent.[2] The margin of error for the county survey is plus

---

[1] Two exceptions were Minneapolis, where we mailed the survey to the property services director, and St. Paul, where the survey went to the real estate manager.

[2] Among cities, 83 of the 96 cities with a population of 8,000 or more responded in time for analysis, for a large-city response rate of 86 percent; 163 of the 200 smaller cities surveyed responded in time for analysis, for a small-city response rate of 82 percent.

Table A.2: Independent and Special School Districts Receiving Survey

- • Ada-Borup
- • Adrian
- • Aitkin
- • Albany
- • Albert Lea
- • Alden-Conger
- • Alexandria
- • Annandale
- • Anoka-Hennepin
- Ashby
- • Atwater-Cosmos-Grove City
- • Austin
- • Badger
- • Bagley
- • Balaton
- • Barnesville
- • Barnum
- • Battle Lake
- • Becker
- • Belgrade-Brooten-Elrosa
- Belle Plaine
- • Bellingham
- Belview
- • Bemidji
- • Benson
- • Bertha-Hewitt
- Big Lake[1]
- • Bird Island-Olivia-Lake Lillian
- • Blackduck
- • Blooming Prairie
- • Bloomington
- • Blue Earth Area
- • Braham
- • Brainerd
- Brandon
- • Breckenridge
- • Brewster
- Brooklyn Center
- • Browerville
- • Browns Valley
- • Buffalo
- • Buffalo Lake-Hector
- • Burnsville
- • Butterfield
- Byron[1]
- • Caledonia
- • Cambridge-Isanti
- • Campbell-Tintah
- • Canby
- • Cannon Falls
- • Carlton
- • Cass Lake
- • Cedar Mountain
- • Centennial
- • Chaska
- • Chisago Lakes
- • Chisholm
- • Chokio-Alberta
- • Chosen Valley
- • Clearbrook-Gonvick
- • Cleveland
- • Climax
- • Clinton-Graceville-Beardsley
- • Cloquet
- • Columbia Heights
- Comfrey[2]
- • Cook County
- • Cromwell
- • Crookston
- Crosby-Ironton[1]
- • Cyrus
- Danube
- • Dassel-Cokato
- • Dawson-Boyd
- • Deer River
- • Delano
- • Detroit Lakes
- • Dilworth-Glyndon-Felton
- Dover-Eyota
- • Duluth
- • Eagle Valley
- • East Central
- • East Grand Forks
- • Eden Prairie
- • Eden Valley-Watkins
- • Edgerton
- • Edina
- • Elgin-Millville
- • Elk River
- • Ellsworth
- • Ely
- • Esko
- • Evansville
- • Eveleth-Gilbert
- • Fairmont Area
- • Faribault
- • Farmington
- • Fergus Falls
- • Fertile-Beltrami
- • Fillmore Central
- • Fisher
- • Floodwood
- • Foley
- • Forest Lake
- • Fosston
- • Frazee
- • Fridley
- Fulda[1]
- Gibbon-Fairfax-Winthrop
- • Glencoe-Silver Lake
- • Glenville-Emmons
- • Goodhue
- • Goodridge
- Granada Huntley-East Chain[1]
- • Grand Meadow
- • Grand Rapids
- • Greenbush-Middle River
- • Greenway
- • Grygla
- • Hancock
- • Hastings
- • Hawley
- • Hayfield
- • Hendricks
- • Henning
- Herman-Norcross
- • Hermantown
- • Heron Lake-Okabena
- • Hibbing
- • Hill City
- • Hills-Beaver Creek
- • Hinckley-Finlayson
- • Holdingford
- • Hopkins
- • Houston
- • Howard Lake-Waverly-Winsted
- • Hutchinson
- International Falls
- • Inver Grove Heights
- • Isle
- • Ivanhoe
- • Jackson County Central
- • Janesville-Waldorf-Pemberton
- • Jordan
- • Kasson-Mantorville
- Kelliher
- Kenyon-Wanamingo
- • Kerkhoven-Murdock-Sunburg
- • Kimball
- Kingsland
- • Kittson Central
- • Lac Qui Parle Valley
- • Lacrescent-Hokah
- • Lake Benton
- • Lake City
- • Lake Crystal-Wellcome Memorial
- • Lake Of The Woods
- • Lake Park-Audubon
- • Lake Superior
- • Lakeview
- • Lakeville
- • Lancaster
- • Lanesboro
- LaPorte
- • LeCenter
- • LeRoy
- • Lester Prairie
- • LeSueur-Henderson
- • Lewiston
- • Litchfield
- • Little Falls
- • Littlefork-Big Falls
- Long Prairie-Grey Eagle
- • Luverne
- • Lyle
- • Lynd
- • Mabel-Canton
- • Madelia
- • Mahnomen
- • Mahtomedi
- • Mankato
- • Maple Lake
- Maple River[1]
- • Marshall
- • Marshall County Central
- • Martin County West
- • Maynard-Clara City-Raymond
- • McGregor
- • McLeod West
- • Medford
- • Melrose
- • Menahga
- Mentor
- • Mesabi East
- • Milaca
- • Milroy
- • Minneapolis
- • Minneota
- • Minnetonka
- • Minnewaska
- • Montevideo
- • Montgomery-Lonsdale
- • Monticello
- • Moorhead
- • Moose Lake
- • Mora
- • Morris
- • Mounds View
- • Mountain Iron-Buhl
- • Mountain Lake
- • Murray County Central
- • Nashwauk-Keewatin
- • Nett Lake
- • Nevis
- • New London-Spicer
- • New Prague
- New Richland-Hartland-Ellendale-Geneva
- • New Ulm
- • New York Mills
- • Nicollet
- • Norman County East
- • Norman County West
- • North Branch
- • North St. Paul-Maplewood
- • Northfield
- • Norwood
- • Ogilvie
- • Oklee
- • Onamia
- Orono
- • Ortonville

Table A.2: Independent and Special School Districts Receiving Survey (continued)

- * Osakis
- * Osseo
- * Owatonna
- * Park Rapids
- * Parkers Prairie
- * Paynesville
- * Pelican Rapids
- * Pequot Lakes
- * Perham
- * Pierz
- * Pillager
- * Pine City
- * Pine Island
- Pine Point
- * Pine River-Backus
- * Pipestone-Jasper
- * Plainview
- * Plummer
- * Princeton
- Prior Lake-Savage[3]
- * Proctor
- * Randolph
- * Red Lake
- * Red Lake Falls
- * Red Rock Central
- * Red Wing
- Redwood Falls
- * Remer-Longville
- Renville
- * Richfield
- Robbinsdale
- Rochester
- * Rockford
- * Rocori
- Roseau
- * Rosemount-Apple Valley-Eagan
- * Roseville
- * Rothsay
- * Round Lake
- Royalton
- * Rush City
- * Rushford-Peterson
- * Russell
- * Ruthton
- Sacred Heart
- * St. Anthony-New Brighton
- * St. Charles
- * St. Clair
- * St. Cloud
- * St. Francis
- * St. James
- * St. Louis County
- * St. Louis Park
- * St. Michael-Albertville
- * St. Paul
- * St. Peter
- * Sartell
- * Sauk Centre
- * Sauk Rapids
- * Sebeka
- * Shakopee
- * Sibley East
- * Sioux Valley
- * Sleepy Eye
- * South Koochiching
- * South St. Paul
- * South Washington County
- Southland[1]
- * Spring Grove
- * Spring Lake Park
- * Springfield
- Staples-Motley[1]
- * Stephen-Argyle Central
- * Stewartville
- * Stillwater
- * Swanville
- * Thief River Falls
- * Tracy
- * Tri-County
- Triton
- * Truman
- * Tyler
- * Ulen-Hitterdal
- * Underwood
- * United South Central
- * Upsala
- * Verndale
- * Virginia
- * Wabasha-Kellogg
- * Wabasso
- * Waconia
- * Wadena-Deer Creek
- * Walker-Hackensack-Akeley
- * Walnut Grove
- * Warren-Alvarado-Oslo
- Warroad
- * Waseca
- * Watertown-Mayer
- * Waterville-Elysian-Morristown
- * Waubun
- * Wayzata
- * West Central Area
- * West St. Paul-Mendota Heights-Eagan
- * Westbrook
- * Westonka
- * Wheaton Area
- * White Bear Lake
- * Willmar
- Willow River
- * Windom
- * Win-E-Mac
- * Winona
- * Worthington
- * Wrenshall
- * Yellow Medicine East
- * Zumbrota-Mazeppa

NOTE: An asterisk (*) depicts school districts from which we received completed surveys in time for analysis.

[1] Returned survey too late to be included in our analysis.

[2] Responded that a survey of the 1998-99 school year would not apply to the district due to the destruction of the district's building by a tornado in 1998.

[3] Responded that the district was unable to complete the survey due to a vacant facility director position.

or minus 3 percentage points. For the city survey, it is plus or minus 5 percentage points. On either survey, the margin of error may be larger for responses to particular questions where the number of respondents is low.

Survey results may also reflect additional sources of error that cannot be measured. We did not independently verify the accuracy of the information respondents provided. Results can be affected by the extent to which respondents interpreted survey questions consistently, and the degree to which their answers accurately reflected conditions in their jurisdictions.

BEST COPY AVAILABLE

Table A.3: Cities Receiving Survey

• Adrian[2]
Akeley[2]
• Albert Lea
Alberta[2]
• Albertville[2]
• Alexandria
• Altura[2]
Andover
• Annandale[2]
• Anoka
• Apple Valley
• Appleton[2]
• Arden Hills
Austin
• Avon[2]
• Backus[2]
• Bayport[2]
• Beaver Bay[2]
• Becker[2]
• Belle Plaine[2]
• Belview[2]
• Bemidji
Bigelow[2]
• Bigfork[2]
• Biscay[2]
Blackduck[2]
• Blaine
• Bloomington
Bock[2]
Bowlus[2]
• Braham[2]
• Brainerd
Brandon[2]
• Breckenridge[2]
• Brook Park[2]
• Brooklyn Center
• Brooklyn Park
Brookston[2]
• Brownsdale[2]
• Buffalo
• Buhl[2]
• Burnsville
Caledonia[2]
Cambridge[2]
• Cannon Falls[2]
Carver[2]
• Cedar Mills[2]
• Centerville[2]
• Champlin
• Chanhassen
Chaska
• Chatfield[2]
• Chickamaw Beach[2]
• Chisholm[2]
• Circle Pines[2]
• Clarissa[2]
Clearwater[2]
• Cleveland[2]
• Cloquet
• Cokato[2]
• Coleraine[2]
• Cologne[2]
• Columbia Heights
• Comfrey[2]
• Coon Rapids
• Corcoran[2]
• Cottage Grove
• Crookston
• Crystal
• Danube[2]
• Dayton[2]
Deephaven[2]
• Deer Creek[2]
Dilworth[2]
Donaldson[2]
• Dovray[2]
• Duluth
Dundas[2]
• Dunnell[2]
• Eagan
• East Bethel
• East Grand Forks
• Eden Prairie
• Eden Valley[2]
• Edina
• Elk River
Emmons[2]
• Erskine[2]
• Fairmont
• Falcon Heights[2]
• Faribault
• Farmington
• Fergus Falls
Fisher[2]
• Floodwood[2]
• Foley[2]
• Forest Lake[2]
• Fort Ripley[2]
• Frazee[2]
• Freeport[2]
• Fridley
• Genola[2]
• Georgetown[2]
• Ghent[2]
• Gilman[2]
Glenwood[2]
• Glyndon[2]
Golden Valley[1]
• Goodhue[2]
• Granada[2]
• Grand Rapids
• Granite Falls[2]
• Grant[2]
• Greenwald[2]
• Greenwood[2]
• Grey Eagle[2]
Halma[2]
• Ham Lake
• Hanley Falls[2]
• Harmony[2]
• Hastings
• Hazel Run[2]
• Henning[2]
Herman[2]
• Heron Lake[2]
• Hibbing
• Hill City[2]
• Hitterdal[2]
• Hoffman[2]
• Hollandale[2]
• Hopkins
• Hoyt Lakes[2]
• Hugo[2]
Hutchinson
Ihlen[2]
• International Falls[2]
• Inver Grove Heights
Ironton[2]
• Isle[2]
• Jeffers[2]
• Kelliher[2]
Kerrick[2]
• Kiester[2]
Kilkenny[2]
• Kimball[2]
• Kinbrae[2]
• La Salle[2]
• Lake City[2]
Lake Crystal[2]
Lake Elmo[2]
Lake Lillian[2]
• Lakeland[2]
• Lakeville
• Lastrup[2]
• Lauderdale[2]
Lengby[2]
• LeRoy[2]
• Lewisville[2]
• Lexington[2]
• Lilydale[2]
• Lino Lakes
• Litchfield[2]
• Little Canada
• Long Prairie[2]
• Loretto[2]
• Lyle[2]
• Madelia[2]
Madison[2]
• Mahnomen[2]
• Mahtomedi[2]
• Mankato
• Maple Grove
• Maple Lake[2]
• Maple Plain[2]
• Mapleton[2]
• Mapleview[2]
Maplewood
• Marshall
Maynard[2]
• Medina[2]
• Melrose[2]
• Mendota[2]
• Mendota Heights
• Miesville[2]
• Milan[2]
• Millville[2]
• Minneapolis
• Minnetonka Beach[2]
• Minnetonka
Montgomery[2]
• Moorhead
• Moose Lake[2]
• Morristown[2]
• Mound
• Mounds View
Mountain Iron[2]
• Mountain Lake[2]
New Brighton
• New Germany[2]
• New Hope
• New Prague[2]
• New Trier[2]
New Ulm
Newport[2]
• Nicollet[2]
• North Mankato
• North St. Paul
Northfield
• Oakdale
• Odessa[2]
• Orono[2]
• Osseo[2]
• Owatonna
• Paynesville[2]
• Pierz[2]
• Pine City[2]
• Pine Springs[2]
• Pipestone[2]
• Plymouth
• Prinsburg[2]
• Prior Lake
• Proctor[2]
• Ramsey
• Red Wing
• Regal[2]
• Richfield
• Richmond[2]
• Robbinsdale
• Rochester
• Rosemount
• Roseville
• Round Lake[2]
• Rush City[2]
• Rushmore[2]
• Sacred Heart[2]
• St. Anthony[2]

Table A.3: Cities Receiving Survey (continued)

- * St. Anthony Village
- * St. Charles[2]
- * St. Cloud
- * St. Hilaire[2]
- * St. Joseph[2]
- * St. Louis Park
- * St. Martin[2]
- * St. Mary's Point[2]
- * St. Paul
- * St. Peter
- * Sandstone[2]
- * Sargeant[2]
- * Sartell
- * Sauk Rapids
- * Savage
- Seaforth[2]
- * Shakopee
- Shoreview
- * Shorewood[2]
- * Silver Bay[2]
- * Skyline[2]
- * South Haven[2]
- * South St. Paul
- * Spicer[2]
- * Spring Grove[2]
- * Spring Hill[2]
- * Spring Park[2]
- * Springfield[2]
- * Stillwater
- * Sunfish Lake[2]
- * Taylors Falls[2]
- * Thief River Falls
- Tower[2]
- Trommald[2]
- * Truman[2]
- * Two Harbors[2]
- * Urbank[2]
- * Vadnais Heights
- * Victoria[2]
- * Virginia
- * Wabasha[2]
- * Wahkon[2]
- * Waite Park[2]
- * Wanamingo[2]
- * Waseca
- West Concord[2]
- * West St. Paul
- * White Bear Lake
- * Willernie[2]
- * Willmar
- Willow River[2]
- Winona
- * Woodbury
- * Woodland[2]
- * Worthington
- * Wrenshall[2]
- * Zemple[2]
- * Zimmerman[2]
- * Zumbro Falls[2]
- * Zumbrota[2]

NOTE: An asterisk (*) depicts cities from which we received completed surveys in time for analysis.

[1] Returned survey too late to be included in our analysis.

[2] City with less than 8,000 population. We mailed surveys to a stratified random sample of 200 smaller cities, and to all 96 cities with populations of 8,000 or more.

Table A.4: Counties Receiving Survey

- * Aitkin County
- * Anoka County
- * Becker County
- Beltrami County
- * Benton County
- * Big Stone County
- Blue Earth County
- * Brown County
- Carlton County
- * Carver County
- * Cass County
- * Chippewa County
- * Chisago County
- * Clay County
- Clearwater County
- * Cook County
- * Cottonwood County
- Crow Wing County[1]
- * Dakota County
- * Dodge County
- * Douglas County
- * Faribault County
- * Fillmore County
- * Freeborn County
- * Goodhue County
- Grant County
- * Hennepin County
- Houston County
- * Hubbard County
- Isanti County
- * Itasca County
- * Jackson County
- * Kanabec County
- * Kandiyohi County
- * Kittson County
- * Koochiching County
- * Lac qui Parle County
- * Lake County
- * Lake of the Woods County
- * Le Sueur County
- * Lincoln County
- * Lyon County
- Mahnomen County
- * Marshall County
- * Martin County
- * McLeod County
- * Meeker County
- * Mille Lacs County
- * Morrison County
- * Mower County
- * Murray County
- * Nicollet County
- * Nobles County
- * Norman County
- * Olmsted County
- Otter Tail County
- * Pennington County
- * Pine County
- * Pipestone County
- * Polk County
- * Pope County
- * Ramsey County
- * Red Lake County
- * Redwood County
- * Renville County
- * Rice County
- * Rock County
- * Roseau County
- * St. Louis County
- Scott County
- * Sherburne County
- * Sibley County
- Stearns County
- * Steele County
- * Stevens County
- * Swift County
- * Todd County
- Traverse County[1]
- * Wabasha County
- * Wadena County
- * Waseca County
- * Washington County
- * Watonwan County
- * Wilkin County
- * Winona County
- Wright County
- * Yellow Medicine County

NOTE: An asterisk (*) depicts counties from which we received completed surveys in time for analysis.

[1] Returned survey too late to be included in our analysis.

School District Surveys

Nearly 89 percent of school districts responded to the survey.

In late October 1999, we mailed surveys to all 347 independent and special school districts. The initial due date was three weeks later. We addressed surveys to facility managers in districts for which we had the facility manager's name. For other districts, we mailed surveys to the business officer, or in cases where we did not have the business officer's name, to the superintendent.[3] Names of facility managers were provided to us by the Minnesota Association of School Maintenance Supervisors, and names of business officers by the Minnesota Association of School Business Officers. To increase our response rate, we extended the deadline to the end of November and mailed follow-up letters and surveys to those who failed to respond by the first due date of November 12.

Of the 347 school districts, 308 returned completed surveys in time for analysis, for a response rate of 88.8 percent.[4] The results have a margin of error of plus or minus 2 percentage points. Because every respondent did not answer all questions in the survey, the margin of error may be larger for responses where the number of respondents is low.

School district survey results may also reflect additional sources of bias that cannot be measured. For the most part, survey results were taken at face value and were not independently verified.[5] Results may be affected by respondents' interpretations of survey questions and their knowledge of conditions in their district. To address one potential source of bias, we reported variations in responses among superintendents, facility managers, and business officers for some school district findings.

SITE VISITS OF SELECT LOCAL JURISDICTIONS

Using data from our surveys, we identified cities and counties meeting our performance standards. To identify school districts, we used our survey data and school district expenditure and facility data collected by the Department of Children, Families, and Learning.[6] From among the many local governments that met a majority of our performance measures, we selected 13 to visit for in-depth interviews on their methods and practices. These jurisdictions were nine school

---

[3] We mailed surveys to facility managers in 127 districts for which we had a facility manager's name, to business officers in 89 districts for which we did not have a facility manager's name, and to superintendents in the remaining 131 districts for which we had neither a facility manager's nor a business officer's name. A breakdown of survey respondents by occupational title indicates that some people receiving surveys transferred their surveys to another staff person to complete: 134 facility managers, 100 superintendents, and 41 business officers responded to our survey (the remaining 33 respondents failed to indicate a specific title).

[4] Two school districts responded in time but did not complete a survey due to unique circumstances.

[5] Staff called some school districts to clarify estimates of person-hours spent on facility maintenance and operations.

[6] *Minn. Stat.* §123B.77 requires school districts to provide financial data each year to the Department of Children, Families, and Learning through the Uniform Financial Accounting and Reporting Standards (UFARS) system.

BEST COPY AVAILABLE

districts, two cities, and two counties, representing different population sizes and regions of the state. We used information gathered during these visits to describe the examples of best practices presented in Chapter 2.

We visited the 13 sites during January 2000. On these visits, we asked about the advantages and disadvantages of specific practices, costs and savings associated with undertaking a practice, and circumstances under which a practice may be transferable to other local jurisdictions. The people we interviewed also offered suggestions and tips for other jurisdictions considering similar practices. To collect the information systematically, we used a standard questionnaire with 11 open-ended questions. A copy of this questionnaire is available on our website at http://www.auditor.leg.state.mn.us/ped/2000/pe0006.htm.

LOCAL GOVERNMENT ADVISORY COUNCIL

When the Minnesota Legislature established the best practices reviews program in 1994, it created a Local Government Advisory Council and charged it with recommending local government services for review. In June 1999 the Advisory Council recommended the topic of preventive maintenance, and the Legislative Audit Commission approved the council's recommendation. Council members also provided feedback on the report by reviewing and commenting on a draft version. Table A.5 lists the individuals currently serving on the Local Government Advisory Council.

Table A.5: Local Government Advisory Council Members, 1999-2000

Charles Meyer (chair), St. Louis Park City Manager
Dave Childs, Minnetonka City Manager
Don Helmstetter, Spring Lake Park Schools Superintendent
Tim Houle, Morrison County Coordinator
Lynn Lander, Hermantown City Administrator
Scott Neal, Northfield City Administrator
Brandt Richardson, Dakota County Administrator
Steve Sarkozy, Roseville City Manager
James Schug, Washington County Administrator
Lothar Wolter, Jr., Norwood Young America Township Clerk

A Checklist for Measuring Performance

APPENDIX B

This appendix lists performance measures that school districts, cities, and counties may use to evaluate their preventive maintenance. As discussed in Appendix A, the performance measures reflect state and federal health and safety requirements as well as guidelines in the building construction and maintenance industries. We used these performance measures as the basis for questions on our surveys of school districts, cities, and counties and to identify jurisdictions with effective and efficient practices.[1]

The next section explains the importance of measuring performance in preventive maintenance and the process for doing so. Following that, we list the performance measures identified during the study. We present them in a checklist format for local jurisdictions that may want to conduct a self-assessment of their performance.

Local jurisdictions may use the checklist for a self-assessment of their performance.

THE VALUE OF PERFORMANCE MEASUREMENT

Performance measures enable school districts, cities, and counties to quantify their progress toward maintenance goals and objectives. Evaluating performance involves analyzing data on the impact, efficiency, and cost-effectiveness of preventive maintenance. Performance data equip local jurisdictions to make informed decisions about modifying or enhancing their preventive maintenance.

Collecting performance-measurement data over time helps local jurisdictions identify which areas of their preventive maintenance programs may need improvement. Further, trend data on personnel costs, equipment expenditures, levels of deferred maintenance, and building occupant satisfaction, for example, can help facility managers develop budget requests and communicate maintenance needs to local policymakers.

Although performance measurement aims to improve the cost-effectiveness of preventive maintenance, measuring performance has its own costs. Securing the resources necessary to measure performance requires local policymakers' support. Performance measurement requires identifying goals and objectives; deciding on yardsticks to measure performance; recording the necessary data; and analyzing the data. Each of these steps involves an investment of resources in the form of personnel time and, in some cases, data-collection tools.

---

[1] Because data were unavailable on some of the measures we identified, we could not use all of the measures listed in this appendix when conducting our analysis.

In addition, performance measurement is not a one-time event. Performance evaluations provide useful information when they are done consistently over time. For some local jurisdictions, computerized maintenance management systems may facilitate the process of gathering, storing, and analyzing performance measurement data.

Defining a Mission, Goals, Objectives, and Measures

The first step in preparing to evaluate preventive maintenance is identifying the overall mission of the preventive maintenance program. A mission describes the fundamental purposes of the program, such as supporting well-maintained buildings and a healthy building environment. The mission serves as the foundation on which goals, objectives, and performance measures are based.

After defining the mission, local governments should set goals for preventive maintenance. Broad goal statements outline what a local jurisdiction intends to achieve with its preventive maintenance, such as maintaining equipment at full operating capacity or conserving energy. Goals should be comprehensive and cover all aspects of the program. In developing their own preventive maintenance goals, school districts, cities, and counties may want to refer to the five key goals of preventive maintenance listed at the beginning of Chapter 2.

Articulating their mission and goals prepares school districts, cities, and counties to develop program objectives. Objectives relate to, but are more specific than, the mission and goals. They target individual preventive maintenance activities, pinpointing what a local jurisdiction aims to achieve and by when. For example, an objective might be to complete preventive maintenance work orders within 72 hours, in support of a goal of maintaining buildings efficiently.

Performance measures quantify the extent to which a local jurisdiction is meeting its objectives. We identified four types of measures: outputs, outcomes, efficiency, and cost-effectiveness. Output measures quantify the amount of services provided. For example, in relation to an objective to complete work orders within 72 hours, an output measure is the number of maintenance work orders completed within 72 hours, by type of maintenance. Outcome measures quantify the results of services. A measure of outcomes related to the work orders objective is an improvement in the percentage of work orders completed on time. Efficiency measures quantify the costs of providing services, and are based on dollars, personnel, or time. An example related to the work orders objective is the number of minutes spent per completed work order. Cost-effectiveness measures quantify the costs associated with achieving desirable results. A measure of cost-effectiveness is the average cost of maintenance personnel and materials to complete work orders successfully within the 72-hour period.

PERFORMANCE MEASURES FOR PREVENTIVE MAINTENANCE

We identified numerous performance measures for evaluating preventive maintenance. Measures are based on state statutes and rules as well as guidelines from professional organizations such as the Building Owners and Managers Association International and the International Facilities Management Association.

In the following list, we converted measures to a "yes or no" format to make it easier for school districts, cities, and counties to conduct a self-assessment by applying them to their own performance. We present the measures in an order that corresponds to the seven best practices recommended in Chapter 2.

Measures related to comprehensive preventive maintenance, as defined in Chapter 3, are designated by an asterisk. Although each measure appears only once, some measures apply to more than one practice. For example, regularly updating building-condition inventories relates both to Best Practice 1 on assessing the condition of buildings and to Best Practice 3 on planning for preventive maintenance.

When we conducted our analysis, we based some of the measures on statewide median rankings among the school districts, cities, and counties responding to our surveys. For example, we compared school districts based on whether the number of preventive maintenance practices they used for most building components was greater than or equal to the median for all school district respondents. As an alternative to using statewide data, local jurisdictions evaluating their program may want to compare their actions to their own base line data or to data from similar jurisdictions in their region.

The following list of measures is not exhaustive. The measures do not represent all performance measures that jurisdictions could use to evaluate preventive maintenance. Individual school districts, cities, and counties may choose to supplement the measures we identified with additional measures related to their specific objectives.

Checklist of Performance Measures[2]

Best Practice 1: Inventory building components and assess their conditions (p. 13 in Chapter 2).

The following performance measures relate to periodically inspecting facility conditions and taking an inventory of building components and equipment.

---

[2] Asterisks denote measures used to define comprehensive preventive maintenance, as described in Chapter 3.

		Yes	No
A.	Does the local government periodically inspect the condition of building components?*	☐	☐
B.	Does the local government keep a comprehensive list of building systems and equipment with information such as location, model type, warranty information, age, and replacement parts?*	☐	☐
C.	Does the local government assign condition ratings to building components?	☐	☐
D.	Does the local government regularly update facility inventories to reflect changes in square footage, value, condition, and maintenance practices?*	☐	☐
E.	Do technicians and managers receive training to conduct the condition assessments?	☐	☐
F.	Do trained technicians and managers use written guidelines, standardized checklists, or automated systems to conduct the assessments?	☐	☐

Best Practice 2: Build the capacity for ranking maintenance projects and evaluating their costs (p. 20).

These performance measures refer to using an objective process to set priorities among maintenance projects. They also apply to calculating the total costs of equipment over its expected lifetime.

		Yes	No
A.	Does the local government have a priority-rating system for maintenance projects that:		
	• helps sort out the relative importance of maintenance and renewal projects?	☐	☐
	• reflects differences in building uses?	☐	☐
	• helps determine funding priorities?	☐	☐
B.	Does the local government use standardized cost data based on an industry-accepted cost estimating system to determine repair and replacement costs?	☐	☐
C.	Does the local government use an evaluation tool, such as life-cycle costing or internal rate of return, to compare building systems and equipment against demonstrated standards and to determine when to replace (instead of continuing to maintain) them?	☐	☐

Best Practice 3: Plan strategically for preventive maintenance in the long- and short-term (p. 29).

These performance indicators refer to building managers' and other local officials' responsibility to develop short- and long-term maintenance plans that include preventive maintenance and are connected to capital and operating budgets.

	Yes	No
A. Does the local government have a written, long-range plan for building maintenance and repairs that:		
• extends out a minimum of three to five years?*	☐	☐
• contains an inventory of all buildings' components and systems, their condition, and estimates of their expected remaining useful life?*	☐	☐
B. As part of the local government's long-range plan, is there a plan to reduce deferred maintenance that includes:		
• a list of major deferred maintenance projects ranked by level of severity and urgency?	☐	☐
• estimates of the costs for reducing the existing backlog?	☐	☐
C. Has the local government prepared a capital plan based on the long-range plan for buildings and their components with cost estimates based on the major components' useful remaining life, and is the capital plan updated annually?*	☐	☐
D. Does the local government establish an adequate facility funding level for ongoing maintenance, such as the recommended guideline of between 2 and 4 percent of current replacement value?	☐	☐
E. Has the local government established reserved funds specifically for renewing and replacing building components?	☐	☐
F. Does the local government develop an annual facilities maintenance plan based on goals and objectives for maintaining buildings?*	☐	☐
G. Is the annual maintenance plan linked to capital and operating budgets?*	☐	☐
H. Does the local government's annual maintenance plan include a labor-needs analysis to determine the total labor hours required to operate and maintain the property, as well as time estimates for unscheduled repairs and emergency work orders?	☐	☐

		Yes	No
I.	Does the local government have estimates of operating costs to maintain or replace buildings' components or systems? Do the estimates include projections of any future savings resulting from equipment replacements?	☐	☐
J.	Have building conditions in the local government improved or stayed at acceptable levels from year to year?	☐	☐
K.	Has the backlog of deferred maintenance declined from year to year?	☐	☐
L.	Is the ratio of deferred maintenance to buildings' current replacement value within an acceptable range around the median for similar jurisdictions (or, alternatively, within acceptable levels in the jurisdiction)?	☐	☐
M.	Is the ratio of preventive maintenance expenditures to estimated deferred maintenance costs within an acceptable range around the median for similar local governments (or, alternatively, within acceptable levels in the jurisdiction)?	☐	☐

Best Practice 4: Structure a framework for operating a preventive maintenance program (p. 43).

The indicators below help evaluate the framework that personnel responsible for building maintenance have established to perform preventive maintenance, including its (1) coordination of preventive maintenance with other maintenance projects, (2) use of a checklist of preventive maintenance tasks, (3) development of a timeline for the tasks, (4) preparation of procedures for managing the program, and (5) coordination of preventive maintenance with activities aimed at controlling indoor air quality.

		Yes	No
A.	Has the local government designated an individual department or employee to coordinate maintenance projects and delegate tasks to employees?	☐	☐
B.	Does the local government have procedure manuals or checklists of tasks for employees to use when performing preventive maintenance?*	☐	☐
C.	Does the local government's preventive maintenance program include one-year schedules that prescribe weekly preventive maintenance activities for specified equipment and components according to manufacturers' recommended frequency or other set intervals?*	☐	☐
D.	Does the schedule estimate the number of work hours needed for each activity?	☐	☐

	Yes	No
E. Does the local government keep acceptable levels of materials and spare parts to support timely repairs?*	☐	☐
F. Does the local government have an indoor air quality (IAQ) management program? Does the IAQ program include:	☐	☐
• a designated IAQ coordinator to manage the IAQ program?	☐	☐
• an IAQ profile, based on existing records and an IAQ assessment, describing the features of the buildings' structure, function, and occupancy that relate to IAQ?	☐	☐
• training in IAQ issues for in-house staff and education for contractors whose functions could affect IAQ?	☐	☐
• an IAQ plan for facility operations and maintenance addressing HVAC operations, cleaning and storage practices, and preventive maintenance?	☐	☐
• procedures for managing processes with potentially significant pollutant sources, including remodeling and renovation, painting, pest control, shipping and receiving, and smoking?	☐	☐
• procedures for responding to IAQ complaints?	☐	☐
• procedures for updating the program when equipment is added or removed?	☐	☐
G. Does the local government's IAQ activities include:		
• inspecting outside air dampers for nearby sources of contamination?	☐	☐
• ensuring that air dampers are clear of obstruction and operating properly?	☐	☐
• regularly replacing or cleaning air filters?	☐	☐
• cleaning and inspecting drain pans?	☐	☐
• inspecting and cleaning heating and cooling coils?	☐	☐
• inspecting and cleaning, as warranted, the interior of air handling units?	☐	☐
• inspecting fan motors and belts?	☐	☐

		Yes	No
•	regularly inspecting and cleaning air humidification equipment and controls?	☐	☐
•	inspecting, cleaning, and treating cooling towers?	☐	☐
•	inspecting and cleaning air distribution pathways and variable air volume boxes?	☐	☐
H.	Is there a high level of customer satisfaction with the building environment and maintenance services?	☐	☐
I.	Is the number of complaints about the building environment within acceptable levels in the jurisdiction?	☐	☐
J.	Does the local government have a low percentage of work orders for emergency or unscheduled repairs compared to the percentage for preventive maintenance and other scheduled repairs?	☐	☐
K.	Has the frequency of equipment failures and service interruptions declined from year to year?	☐	☐
L.	Is a high percentage of buildings, building components, and systems in the jurisdiction in good condition? (See Table 3.1 on p. 85 for the definition of "good condition" used in this report.)	☐	☐
M.	For local governments with buildings in good condition, is the cost per square foot for maintenance and minor repair within an acceptable range around the median for similar jurisdictions (or, alternatively, within acceptable levels in the jurisdiction)?	☐	☐
N.	For local governments with a high percentage of buildings in good condition, are preventive maintenance costs (operating or capital) per square foot within an acceptable range around median costs for similar jurisdictions (or, alternatively, within acceptable levels in the jurisdiction)?	☐	☐
O.	For local governments with a comprehensive preventive maintenance program, are preventive maintenance costs (operating or capital) per square foot within an acceptable range around the median costs for similar jurisdictions (or, alternatively, within acceptable levels in the jurisdiction)? (See p. 82 for the definition of "comprehensive preventive maintenance program" used in this report.)	☐	☐

	Yes	No
P. Are preventive maintenance costs (operating or capital) per square foot within an acceptable range around median costs for similar jurisdictions that have a low ratio of emergency to nonemergency work orders?	☐	☐
Q. Are operating costs for emergency repairs per square foot within an acceptable range around the median for similar jurisdictions (or, alternatively, at an acceptable level in the jurisdiction)?	☐	☐

Best Practice 5: Use tools to optimize the preventive maintenance program (p. 57).

The following measures relate to maximizing benefits from preventive maintenance by incorporating preventive maintenance tasks into a work-order system, keeping systematic maintenance records, and evaluating the preventive maintenance program. They also cover exploring potential efficiencies gained through sharing preventive maintenance services.

	Yes	No
A. Does the local government maintain historical records to document building conditions and the costs of renewing or replacing building components and to provide trend data for updating long-range capital needs?*	☐	☐
B. Does the local government have procedures manuals that provide guidelines for:		
• program planning and control?*	☐	☐
• budget management?*	☐	☐
• coordinating work performed by trade workers and contractors?	☐	☐
• managing emergency situations?	☐	☐
• controlling inventories?	☐	☐
C. Does the local government have policies and procedures that designate responsibility for managing public use of the public buildings during after-school or after-office hours?	☐	☐
D. Does the local government have a management information system (either computerized or manual) to maintain records of department maintenance activities?*	☐	☐

	Yes	No
E. Does the information system allow users to:		
• ascertain the number of work orders outstanding and completed?	☐	☐
• track the maintenance and repair history on individual building components?	☐	☐
• record equipment malfunctions?	☐	☐
• track all maintenance and repair costs?	☐	☐
F. Has the local government developed a process to evaluate the efficiency and effectiveness of preventive maintenance efforts?	☐	☐
G. Does the evaluation process include at least one of the following:		
• setting goals, objectives, and performance measures to review preventive maintenance progress on a periodic basis?	☐	☐
• reviewing records of preventive maintenance activities and system repairs to identify potential problems?	☐	☐
• following a quality assurance program that includes use of maintenance standards; monitoring, inspecting, and evaluating completed work; and developing corrective action plans?	☐	☐
• periodically surveying service recipients or building occupants about the building environment?	☐	☐
• using evaluative methods, such as cost-benefit analyses, to quantify savings due to preventive maintenance efforts?	☐	☐
H. Has the local government explored whether efficiencies can be gained through cooperative maintenance efforts with other jurisdictions or with other agencies within the jurisdiction?	☐	☐
I. Is the average percentage of work orders (out of total monthly work orders) carried over from month to month within an acceptable level in the jurisdiction?	☐	☐

	Yes	No
J. Does the local government have a high percentage of work orders completed within 72 hours or within its own predetermined schedule?	☐	☐
K. For local governments with building occupants indicating a high satisfaction level with building conditions (as measured by a survey of occupants or reduction in the number of complaints per square foot), is the cost per square foot for maintenance and minor repair within a acceptable range around the median for similar jurisdictions (or, alternatively, within acceptable levels in the jurisdiction)?	☐	☐
L. Are operating costs per completed work order for preventive maintenance, repairs, and emergency maintenance within an acceptable range around the median for similar local governments (or, alternatively, at an acceptable level in the jurisdiction)?	☐	☐

Best Practice 6: Advance the competence of maintenance workers and managers (p. 69).

These measures relate to local jurisdictions' responsibility to ensure that maintenance employees receive the training they need to complete their tasks safely and competently.

	Yes	No
A. Does the local government require that maintenance personnel receive training on recognizing and diagnosing the cause of maintenance problems in buildings for which they are responsible?	☐	☐
B. Does the local government provide training in the areas of:		
• energy conservation?	☐	☐
• new facility technologies?	☐	☐
• analyzing the remaining useful life of building components?	☐	☐
C. Does the local government provide additional training for maintenance managers in the subjects of:		
• management skills?	☐	☐
• budget development?	☐	☐
• communication and presentation techniques?	☐	☐

	Yes	No
D. Does the local government provide ongoing training for maintenance workers?	☐	☐
E. Does the local government provide training as required by the U.S. Occupational Safety and Health Act (OSHA) and Minnesota OSHA for activities maintenance workers may be expected to perform?	☐	☐
F. Is the number of person hours per completed work order below the median for similar local governments (or, alternatively, at an acceptable level in the jurisdiction)?	☐	☐

Best Practice 7: Involve appropriate maintenance personnel in decision making and in communicating buildings' needs (p. 75).

The following measures pertain to local officials' responsibility to include maintenance personnel early in decisions about purchasing major components or adding square footage. They also relate to the need for a multiple-level education strategy to inform various audiences about maintenance needs and costs.

	Yes	No
A. Do senior management and policymakers receive periodic reports of appropriate building information tailored to their needs?*	☐	☐
B. Do the reports include the following information:		
• the number and replacement value of all buildings?	☐	☐
• building condition ratings?	☐	☐
• costs of deficiencies?	☐	☐
• costs for long-range renewal of building components based on annual life-cycle funding?	☐	☐
• a plan for managing deferred maintenance projects?	☐	☐
C. Are appropriate maintenance personnel involved in reviewing capital projects, major equipment purchases, and designs for adding square footage to assess potential maintenance problems and identify maintenance costs?	☐	☐
D. Do policymakers have a clear understanding of the scope of maintenance needs and costs?	☐	☐

Summary of Recommended Best Practices

- As a prelude to preventive maintenance, building managers should oversee periodic inspections of buildings' conditions and create an inventory of buildings' components and equipment.

- As building managers determine what maintenance projects are needed, they should use an objective process for setting priorities among them. For cost-effectiveness, building managers should calculate total costs over the expected lifetime of equipment and facilities.

- Local jurisdictions should include preventive maintenance along with other maintenance projects in long- and short-term maintenance plans that are tied to capital improvement programs, capital budgets, reserved accounts, and operating budgets.

- Building managers should (1) coordinate preventive maintenance with other maintenance projects, (2) prepare a checklist of preventive maintenance tasks, (3) schedule a timeline for the tasks, (4) prepare procedures for managing the program, and (5) include preventive maintenance among activities for controlling the quality of air inside buildings.

- To gain optimum benefits from preventive maintenance, building managers should incorporate preventive maintenance tasks into a work-order system and keep systematic maintenance records, either by computer or manually. Managers should evaluate the preventive maintenance program to improve it over time. For added efficiencies, building managers should look for opportunities to share preventive maintenance.

- Local jurisdictions should ensure that their maintenance employees have appropriate training to competently and safely complete the tasks expected of them.

- Local officials should include appropriate maintenance personnel in decisions on facility matters, including purchasing major components or designing new square footage. Doing so can provide insight into future maintenance needs and avoid unnecessary costs. Building managers should develop a multiple-level education strategy to address the differing information needs of their various audiences.

Further Reading

BOOKS, ARTICLES, AND REPORTS

American Public Works Association (APWA). *Public Works Management Practices.* Chicago: APWA, August 1991.

APWA and Building Research Board of the National Research Council. *Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings.* Chicago: APWA, 1991.

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). *ASHRAE Standard 62-1999 Ventilation for Acceptable Indoor Air Quality.* Atlanta: ASHRAE, 1999.

American Society for Testing and Materials (ASTM). *Standard Guide for Selecting Economic Methods for Evaluating Investments in Buildings and Building Systems E 1185-93.* Philadelphia: ASTM, 1993. Includes a list of ASTM standards that explain procedures for using individual methods referenced in the guide.

____________. *Standard Practice for Measuring Life-Cycle Costs of Buildings and Building Systems E 917-94.* Philadelphia: ASTM, 1995.

Applied Management Engineering, PC and Harvey H. Kaiser. *Maintenance Management Audit: A Step by Step Workbook to Better Your Facility's Bottom Line.* Kingston, MA: R.S. Means Company, Inc., 1991.

Applied Management Engineering, PC and Sean C. Rush. *Managing the Facilities Portfolio: A Practical Approach to Institutional Facility Renewal and Deferred Maintenance.* Washington D.C.: National Association of College and University Business Officers, 1991.

Association of School Business Officials (ASBO) International. "Facility Planning and Management." In *Principles of School Business Management*, 2d ed. Reston, VA: ASBO International, 1995.

____________. *Maintenance and Operations and the School Business Administrator: A Compilation of Articles from "School Business Affairs."* Reston, VA: ASBO International, 1995.

____________. *School Facilities Maintenance and Operations Manual.* Reston, VA: ASBO International, 1988.

Avedesian, David A. *How to Design and Manage Your Preventive Maintenance Program.* Washington, D.C.: BOMA International, 1996.

Brown, Donn W. *Facility Maintenance: The Manager's Practical Guide and Handbook.* New York: American Management Association, 1996.

Cotts, David G. *The Facility Management Handbook*, 2d ed. New York: American Management Association, 1999.

Dillow, Rex O. *Facilities Management: A Manual for Plant Administration.* Washington D.C.: The Association of Physical Plant Administrators of Universities and Colleges, 1984.

Earthman, Glen I. *Planning Educational Facilities for the Next Century.* Reston, VA: ASBO International, 1992.

Everson, Christine A. "Local Governments and Schools: Sharing Support Services." *International City/County Management Association Management Information Service Reports* 26, no. 5 (May 1994).

Federal Facilities Council, Standing Committee on Operations and Maintenance. *Budgeting for Facilities Maintenance and Repair Activities.* Washington D.C.: National Academy Press, 1996.

International Facility Management Association (IFMA). "Maintenance, Janitorial and Indirect Costs." In *Benchmarks II.* Houston, TX: IFMA, 1994.

K-12 Facilities and Infrastructure Task Force. *Recommendations of the K-12 Facilities and Infrastructure Task Force.* Report delivered to the Senate K-12 Education Budget Division, St. Paul, 20 January 1999.

K-12 Subcommittee on School Facilities and Infrastructure. *Planning Now for 21st Century Community School Facilities.* Report delivered to the Senate K-12 Education Budget Division, St. Paul, 22 January 1998.

Kaiser, Harvey H. *The Facilities Audit: A Process for Improving Facilities Conditions.* Alexandria, VA: APPA, The Association of Higher Education Facilities Officers, 1993.

————. *The Facilities Manager's Reference.* Kingston, MA: R.S. Means Company, Inc., 1989.

Lufkin, Peter S. and Robert M. Silsbee. *The Whitestone Building Maintenance and Repair Cost Reference 1999,* 5th annual ed. Santa Barbara, CA: Whitestone Research, 1999.

Melvin, Eric. *Plan, Predict, Prevent: How to Reinvest in Public Buildings.* Chicago: APWA, 1992.

Minnesota Department of Children, Families, and Learning. "Indoor Air Quality Operations and Maintenance Manual." Indoor air quality information and checklists for school district personnel. St. Paul.

————————. *Results of the 1999 Facilities Capital Needs Survey.* Roseville, March 1999.

————————. *Status of Public School Facilities in Minnesota: A Report to the 1997 Legislature.* St. Paul, 1997.

Minnesota House Research Department. *Minnesota School Finance: A Guide for Legislators.* St. Paul, December 1998.

National Research Council. *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets.* Washington D.C.: National Academy Press, 1998.

Office of the Legislative Auditor. *School District Finances.* St. Paul: Office of the Legislative Auditor, February 2000.

————————. *State Building Maintenance.* St. Paul: Office of the Legislative Auditor, February 1998.

R. S. Means Company, Inc. *Cost Planning & Estimating for Facilities Maintenance.* Kingston, MA: R. S. Means Company, Inc., 1996.

————————. *Facilities Maintenance & Repair Cost Data 1998.* Kingston, MA: R. S. Means Company, Inc., 1998.

U.S. Advisory Commission on Intergovernmental Relations (ACIR) and U.S. Army Corps of Engineers. *High Performance Public Works: A New Federal Infrastructure Investment Strategy for America.* Washington D.C.: U.S. ACIR, November 1993.

U.S. Environmental Protection Agency (EPA). *Building Air Quality Action Plan.* Washington, D.C.: U.S. Government Printing Office, 1998.

————————. *Indoor Air Quality Tools for Schools* (Washington D.C.: U.S. Government Printing Office, 1998); http://www.epa.gov/iaq/schools; accessed December 2, 1999.

U.S. EPA and National Institute for Occupational Safety and Health. *Building Air Quality: A Guide for Building Owners and Facility Managers.* Washington, D.C.: U.S. Government Printing Office, December 1991.

U.S. General Accounting Office (GAO). *School Facilities: America's Schools Report Differing Conditions.* Washington D.C.: U.S. GAO, June 1996.

Vaday, Gregory. "Planning for Capital Improvements." *International City/County Management Association Management Information Service Reports* 25, no. 10, October 1993.

Westerkamp, Thomas A. *Maintenance Manager's Standard Manual,* 2d ed. Paramus, NJ: Prentice Hall, 1997.

WEBSITES

American Public Works Association: http://www.pubworks.org/organization/facilities.htm

American School & University Magazine: http://www.asumag.com/magazine/

American Society of Heating, Refrigerating and Air-Conditioning Engineers: http://www.ashrae.org/

Building Owners and Managers Association International: http://www.boma.org/

FacilitiesNet: http://www.facilitiesnet.com/fn

Federal Facilities Council: http://www4.nationalacademies.org/cets/ffc.nsf

FMLink: http://www.fmlink.com/

International Facility Management Association: http://www.ifma.org/

Minnesota Department of Children, Families, and Learning, Facilities/Organization (includes information for school districts on school construction, procedures, and projects): http://cfl.state.mn.us/FACILIT/facilit.htm

National Institute of Building Sciences: http://www.nibs.org/fmochome.htm

School Planning & Management Magazine: http://www.spmmag.com/

University of Minnesota, University Services, Department of Campus Health and Safety, Department of Environmental Health and Safety, School Indoor Air Quality Questions: http://www.dehs.umn.edu/schooliaq.html

U.S. Department of Education, Educational Resources Information Center, National Clearinghouse for Educational Facilities: http://www.edfacilities.org/

Recent Program Evaluations

Truck Safety Regulation, January 1992	92-01
State Contracting for Professional/Technical Services, February 1992	92-02
Public Defender System, February 1992	92-03
Higher Education Administrative and Student Services Spending: Technical Colleges, Community Colleges, and State Universities, March 1992	92-04
Regional Transit Planning, March 1992	92-05
University of Minnesota Supercomputing Services, October 1992	92-06
Petrofund Reimbursement for Leaking Storage Tanks, January 1993	93-01
Airport Planning, February 1993	93-02
Higher Education Programs, February 1993	93-03
Administrative Rulemaking, March 1993	93-04
Truck Safety Regulation, Update, June 1993	93-05
School District Financial Reporting, Update, June 1993	93-06
Public Defender System, Update, December 1993	93-07
Game and Fish Fund Special Stamps and Surcharges, Update, January 1994	94-01
Performance Budgeting, February 1994	94-02
Psychopathic Personality Commitment Law, February 1994	94-03
Higher Education Tuition and State Grants, February 1994	94-04
Motor Vehicle Deputy Registrars, March 1994	94-05
Minnesota Supercomputer Center, June 1994	94-06
Sex Offender Treatment Programs, July 1994	94-07
Residential Facilities for Juvenile Offenders, February 1995	95-01
Health Care Administrative Costs, February 1995	95-02
Guardians Ad Litem, February 1995	95-03
Early Retirement Incentives, March 1995	95-04
State Employee Training: A Best Practices Review, April 1995	95-05
Snow and Ice Control: A Best Practices Review, May 1995	95-06
Pollution Control Agency's Use of Administrative Penalty Orders, Update July 1995	95-07
Development and Use of the 1994 Agency Performance Reports, July 1995	PR95-22
State Agency Use of Customer Satisfaction Surveys, October 1995	PR95-23
Funding for Probation Services, January 1996	96-01
Department of Human Rights, January 1996	96-02
Trends in State and Local Government Spending, February 1996	96-03
State Grant and Loan Programs for Businesses February 1996	96-04

Post-Secondary Enrollment Options Program, March 1996	96-05
Tax Increment Financing, March 1996	96-06
Property Assessments: Structure and Appeals, A Best Practices Review, May 1996	96-07
Recidivism of Adult Felons, January 1997	97-01
Nursing Home Rates in the Upper Midwest, January 1997	97-02
Special Education, January 1997	97-03
Ethanol Programs, February 1997	97-04
Statewide Systems Project, February 1997	97-05
Highway Spending, March 1997	97-06
Non-Felony Prosecution, A Best Practices Review, April 1997	97-07
Social Service Mandates Reform, July 1997	97-08
Child Protective Services, January 1998	98-01
Remedial Education, January 1998	98-02
Transit Services, February 1998	98-03
State Building Maintenance, February 1998	98-04
School Trust Land, March 1998	98-05
9-1-1 Dispatching: A Best Practices Review, March 1998	98-06
Minnesota State High School League, June 1998	98-07
State Building Code, January 1999	99-01
Juvenile Out-of-Home Placement, January 1999	99-02
Metropolitan Mosquito Control District, January 1999	99-03
Animal Feedlot Regulation, January 1999	99-04
Occupational Regulation, February 1999	99-05
Directory of Regulated Occupations in Minnesota, February 1999	99-05b
Counties' Use of Administrative Penalties for Violations of Solid and Hazardous Waste Ordinances, February 1999	99-06
Fire Services: A Best Practices Review, April 1999	99-07
State Mandates on Local Governments, January 2000	00-01
State Park Management, January 2000	00-02
Welfare Reform, January 2000	00-03
School District Finances, February 2000	00-04
State Employee Compensation, February 2000	00-05
Preventive Maintenance for Local Government Buildings: A Best Practices Review, April 2000	00-06
Minnesota State Colleges and Universities: Status Report, forthcoming	00-07

Evaluation reports can be obtained free of charge from the Legislative Auditor's Office, Program Evaluation Division, Room 140, 658 Cedar Street, Saint Paul, Minnesota 55155, 651/296-4708. Full text versions of recent reports are also available at the OLA web site: http://www.auditor.leg.state.mn.us

BEST COPY AVAILABLE

Survey of School Districts

As part of the best practices review on preventive maintenance for local government buildings, the Office of the Legislative Auditor surveyed the 347 independent and special school districts in Minnesota. The aggregate results of school districts' responses are available here.

The October 1999 survey went to facility managers in those school districts for which we had a facility manager's name. For other districts, we mailed surveys to the business officer or, if we did not have the business officer's name, to the superintendent. We received responses from 308 of the 347 independent and special school districts in Minnesota, for a response rate of 88.8 percent.

We asked school districts about their preventive maintenance practices during the 1998-99 school year. The survey also included questions on planning and funding preventive maintenance as well as on obstacles limiting school districts' ability to perform preventive maintenance.

Survey results on preventive maintenance in Minnesota cities and counties are also available on our website. For additional information on survey methodology, see Appendix A in the report.

Minnesota Office of the Legislative Auditor

Managing Preventive Maintenance for Local Government Buildings: A Best Practices Review

School District Survey

RESPONSE RATE:

We received responses from 308 of the 347 independent and special school districts in Minnesota, for a response rate of 88.8 percent.

Name: ______________________

Title: ______________________

Telephone: ______________________

Defining Preventive Maintenance—For this study, preventive maintenance means activities to extend the useful life of a building's components, including its roofing, plumbing, heating, ventilation, air conditioning, electrical systems, exterior and interior construction and finishing. Preventive maintenance activities are those intended to prevent breakdowns, and they include periodic inspections, scheduled minor and major maintenance, and minor repairs. They may also include predictive testing to determine building components' remaining useful life. Preventive maintenance may be funded from the general fund or other funds.

What Is and Is Not Included—Preventive maintenance does *not* include daily custodial work such as sweeping, mopping, emptying wastebaskets, cleaning restrooms, and moving furniture. Unless otherwise specified, this survey excludes maintenance to preserve grounds, playgrounds, and athletic facilities.

Preventive maintenance includes regularly scheduled painting, resurfacing, lubricating, replacing parts, inspecting, testing, and renewing facility components. For instance, vacuuming a carpet is general maintenance; periodically shampooing the carpet according to manufacturers' recommendations is preventive maintenance.

As an everyday example, filling a car with gasoline and checking the oil level are general maintenance. Changing the oil and oil filter every 5,000 miles as recommended by the car manufacturer is preventive maintenance.

Defining Deferred and Emergency Maintenance—Deferred maintenance refers to projects that were needed to maintain components' useful life or correct existing problems but were postponed due to lack of resources. Emergency maintenance is unscheduled work requiring immediate action to repair or replace failed components, such as for power or heat loss.

Completing This Survey—Unless otherwise specified, survey questions pertain to the 1998-99 school year. The questions apply only to buildings owned, not leased, by the district. If necessary, please consult with other staff in your district to answer the questions.

1. Does a districtwide office oversee facility maintenance for your school district? *(Mark one answer.)* (*N*=290)

Number	Percent	
236	81.4%	1. Yes, a districtwide office provides oversight of maintenance.
42	14.5	2. No, site-based management oversees maintenance in each building.
12	4.1	3. Other *(Please specify.)* ______________________

BEST COPY AVAILABLE

2. In managing preventive maintenance, does your school district use the following practices? *(Mark one answer for each practice.)*

Practice	For Most Building Components		For Some Building Components		We Do Not Use This Practice	
	Number	Percent	Number	Percent	Number	Percent
a. Maintain a current list of buildings' components and equipment (*N*=305)	144	47.2%	118	38.7%	43	14.1%
b. Schedule preventive maintenance tasks according to manufacturers' recommendations or at other set intervals (*N*=306)	160	52.3	118	38.6	28	9.2
c. Prepare checklists of preventive maintenance tasks for employees (*N*=304)	115	37.8	110	36.2	79	26.0
d. Maintain supply of materials and spare parts to allow timely maintenance (*N*=306)	124	40.5	166	54.2	16	5.2
e. Analyze maintenance records to identify problems before components fail (*N*=305)	57	18.7	147	48.2	101	33.1
f. Inspect building systems and equipment prior to warranty expirations (*N*=307)	128	41.7	125	40.7	54	17.6
g. Perform preventive maintenance activities according to formal written plans (*N*=304)	62	20.4	126	41.4	116	38.2
h. Keep comprehensive records of preventive maintenance activities and their costs (*N*=306)	63	20.6	133	43.5	110	35.9
i. Develop guidelines for planning and budgeting preventive maintenance (*N*=303)	85	28.1	133	43.9	85	28.1

3. Have any obstacles limited your ability to do preventive maintenance?

Number	Percent	(*N*=300)
72	24.0%	1. No. *(Go to Question 4.)*
228	76.0	2. Yes, we have had problems with the following: *(Please indicate how serious each obstacle has been for your school district.)*

Obstacles	Very Serious		Somewhat Serious		Not Very Serious, If At All	
	Number	Percent	Number	Percent	Number	Percent
a. Numerous emergency or unscheduled major repairs that preclude preventive maintenance (*N*=225)	31	13.8%	114	50.7%	80	35.6%
b. Not enough staff hours available for the necessary work (*N*=225)	90	40.0	116	51.6	19	8.4
c. Labor shortages in the region (*N*=221)	37	16.7	85	38.5	99	44.8
d. Too little training or expertise to implement preventive maintenance (*N*=225)	18	8.0	128	56.9	79	35.1
e. Competition with other district expenditures for limited dollars (*N*=225)	120	53.3	80	35.6	25	11.1
f. Funding new construction without considering resulting increased maintenance needs (*N*=220)	48	21.8	75	34.1	97	44.1

Question 3, continued …

Obstacles	Very Serious Number	Very Serious Percent	Somewhat Serious Number	Somewhat Serious Percent	Not Very Serious, If At All Number	Not Very Serious, If At All Percent
g. School board has not made preventive maintenance a high priority (*N*=220)	26	11.8%	85	38.6%	109	49.5%
h. Inexperience presenting building maintenance information to school board (*N*=222)	5	2.3	62	27.9	155	69.8
i. Difficulty hiring contracted maintenance services during the traditional three-month summer break (*N*=224)	16	7.1	89	39.7	119	53.1
j. Limits imposed by the state on the property taxes school districts may levy (*N*=225)	83	36.9	104	46.2	38	16.9
k. Funding restrictions that dissuade spending on preventive maintenance, such as those limiting spending to only certain purposes *(Please specify.)* (*N*=218)	68	31.2	92	42.2	58	26.6
l. State or local requirements related to maintaining buildings or planning their maintenance, such as building codes *(Please specify.)* (*N*=215)	24	11.2	73	34.0	118	54.9
m. Other obstacles *(Please specify.)* (*N*=51)	12	23.5	18	35.3	21	41.2

4. Do you monitor building conditions in the district?

All Respondents Number	All Respondents Percent	Respondents Monitoring Building Conditions Number	Respondents Monitoring Building Conditions Percent	
	(*N*=305)		(*N*=278)	
29	9.5%			1. No. *(Go to Question 5.)*
276	90.5			2. Yes, we do the following: *(Mark all that apply.)*
160	52.5	160	57.6%	a. Keep a current list of building components and equipment
254	83.3	254	91.4	b. Assess the condition of buildings and major components at least once every three years
207	67.9	207	74.5	c. Train employees to identify maintenance needs
73	23.9	73	26.3	d. Use written guidelines to perform the assessments
167	54.8	167	60.1	e. Analyze the remaining useful life of building components
139	45.6	139	50.0	f. Rely on standardized inspections for consistent results over time
16	5.2	16	5.8	g. Other *(Please specify.)* ____________

5. **In your opinion, what was the overall condition of your district's facilities in 1998-99?** *(Using the definitions below, circle one answer that best describes overall conditions for each component or facility.)*

Good: Components are structurally sound and only general maintenance and minor repair are required; little or no deferred maintenance exists. Few systems fail, and they allow uninterrupted daily use of the facilities.

Fair: Components show signs of slight deterioration and some corrective maintenance and major repairs are required; some deferred maintenance exists. Systems fail occasionally, causing some interruptions in daily use of the facilities.

Poor: Components show signs of severe deterioration and corrective maintenance and emergency repairs are often required; deferred maintenance is extensive. Systems fail frequently, causing ongoing interruptions in daily use of the facilities.

Component or Facility	Good		Fair		Poor		Uncertain or Don't Know		Schools Did Not Have	
	#	%	#	%	#	%	#	%	#	%
a. Heating, ventilation, and air-conditioning systems (*N*=294)	117	39.8%	149	50.7%	28	9.5%	0	0.0%	0	0.0%
b. Plumbing systems (*N*=293)	104	35.5	158	53.9	30	10.2	1	0.3	0	0.0
c. Roofs (*N*=295)	134	45.4	133	45.1	28	9.5	0	0.0	0	0.0
d. Elevators (*N*=292)	161	55.1	28	9.6	6	2.1	2	0.7	95	32.5
e. Electrical and lighting systems (*N*=293)	161	54.9	112	38.2	20	6.8	0	0.0	0	0.0
f. Life-safety systems, such as fire alarms (*N*=295)	240	81.4	52	17.6	3	1.0	0	0.0	0	0.0
g. Interior finishes, such as walls, floors, ceilings, doors (*N*=293)	137	46.8	136	46.4	20	6.8	0	0.0	0	0.0
h. Structural components, such as exterior facades, foundations, windows (*N*=295)	116	39.3	149	50.5	30	10.2	0	0.0	0	0.0
i. Parking lots and roadways (*N*=295)	107	36.3	126	42.7	57	19.3	0	0.0	5	1.7
j. Grounds, playgrounds, and athletic fields (*N*=295)	123	41.7	147	49.8	25	8.5	0	0.0	0	0.0

6. **Do you provide periodic reports on building conditions and needs to the superintendent and school board?**

All Respondents Number	All Respondents Percent	Respondents Providing Reports Number	Respondents Providing Reports Percent	(*N*=302)
69	22.8%			1. No. *(Go to Question 7.)*
233	77.2			2. Yes, the reports include the following: *(Mark all that apply.)*
				(*N*=233)
57	18.9	57	24.5%	a. Number and replacement value of buildings
96	31.8	96	41.2	b. Condition ratings of the buildings
191	63.2	191	82.0	c. Estimated costs of building deficiencies
152	50.3	152	65.2	d. Needs for replacement of building components based on annual life-cycle funding
158	52.3	158	67.8	e. Plan for managing deferred maintenance projects

BEST COPY AVAILABLE

7. In considering decisions to maintain, repair, or replace building components, which of the following practices do you use? *(Mark one answer for each practice.)*

Practice	For Most Building Components		For Some Building Components		We Do Not Use This Practice	
	Number	Percent	Number	Percent	Number	Percent
a. Determine life-cycle costs, including initial cost, annual maintenance and energy costs, and salvage value (*N*=272)	60	22.1%	121	44.5%	91	33.5%
b. Estimate repair and replacement costs using a cost-estimating system (*N*=275)	92	33.5	125	45.5	58	21.1
c. Use predictive maintenance, such as vibration analysis, to project when components are likely to fail (*N*=273)	17	6.2	55	20.1	201	73.6

8. When replacing major building components, how frequently does the school district do the following? *(Mark one answer for each practice.)*

Practice	Consistently		Occasionally		Rarely, If Ever	
	Number	Percent	Number	Percent	Number	Percent
a. Purchase components designed to allow low-cost maintenance over time (*N*=301)	136	45.2%	142	47.2%	23	7.6%
b. Involve personnel with maintenance expertise in purchasing and/or design decisions (*N*=301)	181	60.1	102	33.9	18	6.0

9. Does your school district have an indoor air quality (IAQ) program?

All Respondents Number	All Respondents Percent	(*N*=303)
33	10.9%	1. No. *(Go to Question 10.)*
270	89.1	2. Yes, the program includes the following: *(Mark all that apply.)*

All Respondents Number	All Respondents Percent	Respondents With an IAQ Program Number	Respondents With an IAQ Program Percent	(*N*=271)
239	78.9	239	88.2%	a. A person designated as IAQ coordinator
204	67.3	204	75.3	b. Use of prepared materials, such as "Tools for Schools," to develop an IAQ program
201	66.3	201	74.2	c. An IAQ assessment with an annual review to identify problems
157	51.8	157	57.9	d. IAQ training for in-house staff or information for contractors whose functions could affect indoor air
187	61.7	187	69.0	e. An IAQ plan for facility operations and maintenance
171	56.4	171	63.1	f. Procedures for managing activities, such as painting or pest control, that could harm air quality
221	72.9	221	81.5	g. Procedures for responding to IAQ complaints
111	36.6	111	41.0	h. School board review of IAQ program status and needs

10. Which of the following training does your school district require for maintenance employees? *(This is training beyond that required for licenses they may hold, such as boiler licenses. Mark one answer for each type of training required, regardless of whether it has been successfully completed.)*

Training	Required of Employees Expected to Perform These Tasks		Not Required of Employees Expected to Perform These Tasks		Not Applicable, Maintenance Employees Do Not Perform These Tasks	
	Number	Percent	Number	Percent	Number	Percent
a. Management and leadership skills (*N*=280)	58	20.7%	139	49.6%	83	29.6%
b. Budget development (*N*=280)	38	13.6	87	31.1	155	55.4
c. Preventive maintenance activities (*N*=284)	186	65.5	85	29.9	13	4.6
d. Communication skills (*N*=277)	89	32.1	136	49.1	52	18.8
e. Public presentation skills and techniques (*N*=278)	26	9.4	116	41.7	136	48.9
f. New facility technologies (*N*=281)	103	36.7	105	37.4	73	26.0
g. Energy conservation strategies (*N*=280)	130	46.4	112	40.0	38	13.6
h. OSHA-required training, such as asbestos awareness or the use of personal protective equipment (*N*=287)	275	95.8	8	2.8	4	1.4
i. Diagnosing causes of maintenance problems (*N*=277)	168	60.6	93	33.6	16	5.8
j. Analyzing the remaining useful life of facility components and equipment (*N*=280)	79	28.2	127	45.4	74	26.4
k. General maintenance and minor repairs (*N*=286)	219	76.6	62	21.7	5	1.7

FINANCING

Unless otherwise specified, the following questions pertain to financing all facility maintenance, meaning general maintenance and major repairs in addition to preventive maintenance. Facilities include grounds, playgrounds, parking lots, and athletic facilities, in addition to buildings. If necessary, please consult with other staff in your district to answer these questions.

11. Does your district develop a capital plan for funding maintenance and replacement of facility components?

All Respondents Number	All Respondents Percent	(*N*=301)		
46	15.3%	1. No. *(Go to Question 12.)*		
255	84.7	2. Yes, the plan includes the following: *(Mark all that apply.)*		
		Respondents With a Capital Plan Number	Percent	(*N*=257)
232	77.1	232	90.3%	a. Capital needs based on priorities identified in a long-range plan for facility maintenance
125	41.5	125	48.6	b. Cost estimates based on the remaining useful life of major components
212	70.4	212	82.5	c. An outlook covering several years into the future
165	54.8	165	64.2	d. Provisions for preventive maintenance activities
214	71.1	214	83.3	e. Annual updates

BEST COPY AVAILABLE

12. What do you estimate was the current replacement value of your district's facilities in the 1998-99 school year? *(By current replacement value, we mean the amount needed to reproduce your facilities and equipment at current market prices. Insurance policies typically include "current insured value," which may be used here.)* (*N*=229)

Mean	Median	
$ 52,380,374.80	$ 22,500,000.00	Current replacement value

13. Some local governments decide how much to reinvest in maintaining their facilities by calculating a percentage of their facilities' current replacement value. Does your school district do this? *(Mark one.)* (*N*=290)

Number	Percent	
283	97.6%	1. No. *(Go to Question 14.)*
7	2.4	2. Yes.

13.(a) If yes, what was this percentage for the 1998-99 school year? (*N*=7)

Mean	Median	
3.12%	2.00%	of current replacement value for maintenance

14. Has your school district used "guaranteed energy savings contracts" to finance facility improvements and maintenance? (*N*=298)

Number	Percent	
171	57.4%	1. No. *(Go to Question 15.)*
127	42.6	2. Yes. Based on my experience the contracts' effectiveness was: *(Mark one answer that best describes your opinion of their effectiveness in each area.)*

	Very Effective		Somewhat Effective		Neither Effective Nor Ineffective		Somewhat Ineffective		Very Ineffective		Uncertain or Don't Know	
	#	%	#	%	#	%	#	%	#	%	#	%
a. For improving facilities (*N*=126)	39	31.0%	62	49.2%	11	8.7%	5	4.0%	5	4.0%	4	3.2%
b. For saving money to pay for improvements* (*N*=129)	28	21.7	59	45.7	17	13.2	9	7.0	7	5.4	9	7.0

* The number of respondents to this question exceeds the number indicating they used guaranteed energy savings contracts because two respondents who failed to indicate that they used such a contract responded to the remainder of Question 14.

15. To the best of your knowledge, what was the dollar value of *deferred* maintenance backlog in your school district by the end of 1998-99? *(Include costs of maintenance projects you had identified as necessary but that had been postponed due to lack of resources. Exclude costs for new construction, building additions, or projects not intended to correct existing deficiencies.)* (*N*=239)

Mean	Median	
$ 3,545,665.03	$ 240,500.00	in deferred maintenance

If you do not actively manage preventive maintenance for at least some building components, as indicated by your responses to Question 2 on page 2, please skip to Question 28.

BEST COPY AVAILABLE

16. Does your school district fund preventive maintenance?

Number	Percent	(*N*=285)
62	21.8%	1. No. *(Go to Question 18.)*
223	78.2	2. Yes. *(Please indicate how consistently the school district does the following:)*

Practice	Consistently		Sometimes		Rarely, If Ever	
	Number	Percent	Number	Percent	Number	Percent
a. Each year we set aside money for preventive maintenance of our buildings. (*N*=221)	131	59.3%	74	33.5%	16	7.2%
b. We set priorities for preventive maintenance that do not compete for funding with capital projects. (*N*=213)	76	35.7	106	49.8	31	14.6
c. We set aside money for preventive maintenance based on the annual depreciation of building systems and equipment. (*N*=210)	35	16.7	53	25.2	122	58.1
d. We rely on reserved accounts (other than the operating capital reserve) to fund preventive maintenance. (*N*=200)	24	12.0	65	32.5	111	55.5
e. Other *(Please specify.)* (*N*=8)________________	2	25.0	1	12.5	5	62.5

17. Based on your experiences, what practices for funding preventive maintenance do you find particularly effective?

PREVENTIVE MAINTENANCE PLANNING

The following questions pertain to planning and managing preventive maintenance for district buildings.

18. Did you have a written, long-range plan for maintenance in 1998-99 that extended out at least three to five years?

All Respondents				
Number	Percent	(*N*=290)		
135	46.6%	1. No. *(Go to Question 19.)*		
155	53.4	2. Yes, it included the following: *(Mark all that apply.)*		
		Respondents With a Written, Long-Range Plan		
		Number	Percent	(*N*=156)
67	23.1	67	42.9%	a. An inventory of the condition and expected useful life of buildings and their components
136	46.9	136	87.2	b. Expected maintenance projects, including preventive maintenance
141	48.6	141	90.4	c. An estimate of costs to maintain or replace components
76	26.2	76	48.7	d. Projected changes in student populations and building uses
101	34.8	101	64.7	e. Deferred maintenance projects listed in priority order
4	1.4	4	2.6	f. Other *(Please specify.)* ________________

19. Do you have an annual building maintenance plan to identify preventive maintenance expected for the coming year?

All Respondents Number	Percent	(*N*=287)
96	33.4%	1. No. *(Go to Question 20.)*
191	66.6	2. Yes, the plan includes the following: *(Mark all that apply.)*

All Respondents Number	Percent	Respondents With an Annual Plan Number	Percent		(*N*=191)
175	61.0	175	91.6%	a.	A workplan of projects expected to be completed in the year
70	24.4	70	36.6	b.	Plans to reduce the backlog of deferred maintenance
54	18.8	54	28.3	c.	An analysis of labor needs, including labor for unscheduled repairs and emergencies
75	26.1	75	39.3	d.	A mid-year review and updating of the building maintenance plan
100	34.8	100	52.4	e.	Links between the building maintenance plan and the budget for maintenance
70	24.4	70	36.6	f.	Guidelines for responding to emergencies and unanticipated equipment failures
162	56.4	162	84.8	g.	Cost estimates for capital needs such as major repairs or component replacement
132	46.0	132	69.1	h.	Cost estimates for annual operations, including utilities, preventive maintenance, design and engineering, minor repair, and general maintenance
105	36.6	105	55.0	i.	Cost estimates for personnel and overhead such as salaries and benefits, training, contract labor, and office equipment

20. Do you have one or more processes for ranking the importance of preventive maintenance projects?

All Respondents Number	Percent	(*N*=279)
117	41.9%	1. No. *(Go to Question 21.)*
162	58.1	2. Yes, the process includes the following: *(Mark all that apply.)*

All Respondents Number	Percent	Respondents With Process for Ranking Number	Percent		(*N*=163)
47	16.8	47	28.8%	a.	Written guidelines that distinguish urgent projects requiring immediate action from those that can be delayed
97	34.8	97	59.5	b.	A procedure to route high priority projects into the maintenance work-order system
70	25.1	70	42.9	c.	Specifying when each project should begin
86	30.8	86	52.8	d.	Setting priorities according to how buildings are used, such as whether buildings are frequently occupied
118	42.3	118	72.4	e.	Annual revisions of priorities based on completed projects and condition changes
9	3.2	9	5.5	f.	Other *(Please specify.)* ______________________________

BEST COPY AVAILABLE

21. Did you have a management information system for tracking and analyzing maintenance projects in 1998-99? *(Mark one.)*

All Respondents Number	Percent	(N=288)
224	77.8%	1. No, we did not have a management information system. *(Go to Question 22.)*
30	10.4	2. Yes, we had a computerized management information system.
34	11.8	3. Yes, we had a manual management information system.

21.(a) If you did have a management information system, which of the following did it provide? *(Mark all that apply.)*

		Respondents With an MIS Number	Percent	(N=69)
49	17.0	49	71.0%	a. Number of work orders completed and outstanding
45	15.6	45	65.2	b. Maintenance and repair history on individual building components or equipment
32	11.1	32	46.4	c. Records of equipment malfunctions
37	12.8	37	53.6	d. Histories of costs for preventive maintenance, repairs, and replacement of components
20	6.9	20	29.0	e. Estimates of work hours needed for each type of maintenance activity
16	5.6	16	23.2	f. Records of changes over time in the condition of building components
2	0.7	2	2.9	g. Other *(Please specify.)* ____________

22. Do you evaluate the efficiency and effectiveness of your preventive maintenance?

All Respondents Number	Percent	(N=285)
162	56.8%	1. No. *(Go to Question 23.)*
123	43.2	2. Yes, we evaluate by: *(Mark all that apply.)*

		Respondents Evaluating Preventive Maintenance Number	Percent	(N=123)
50	17.5	50	40.7%	a. Measuring progress towards meeting preventive maintenance goals
62	21.8	62	50.4	b. Reviewing preventive maintenance records to identify potential problems
70	24.6	70	56.9	c. Analyzing costs and benefits of preventive maintenance to quantify savings
83	29.1	83	67.5	d. Surveying building occupants to assess satisfaction levels about building environments
51	17.9	51	41.5	e. Following a quality assurance program with maintenance work standards and inspections of completed work
50	17.5	50	40.7	f. Comparing trends in frequency of malfunctioning components and equipment
5	1.8	5	4.1	g. Other *(Please specify.)* ____________

23. Based on your experiences, what practices for planning or managing preventive maintenance do you find particularly effective or innovative?

PERSONNEL

The following questions on personnel pertain specifically to school districts that perform at least some preventive maintenance.

24. Did your school district use in-house staff or contracts with private firms to perform preventive maintenance on the following in 1998-99? *(Mark one answer for each component or facility.)*

Component or Facility	In-House Staff for Most or All Preventive Maintenance		Contracted Services for Most or All Preventive Maintenance		Combination of In-House And Contracted Services		No Preventive Maintenance Was Provided		Schools Did Not Have	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
a. Heating, ventilation, and air-conditioning systems (*N*=292)	54	18.5%	52	17.8%	180	61.6%	4	1.4%	2	0.7%
b. Plumbing systems (*N*=291)	80	27.5	33	11.3	147	50.5	28	9.6	3	1.0
c. Roofs (*N*=291)	23	7.9	173	59.5	74	25.4	16	5.5	5	1.7
d. Elevators (*N*=284)	5	1.8	172	60.6	12	4.2	4	1.4	91	32.0
e. Electrical and lighting systems (*N*=289)	45	15.6	107	37.0	120	41.5	13	4.5	4	1.4
f. Life-safety systems such as fire alarms (*N*=292)	4	1.4	226	77.4	60	20.5	1	0.3	1	0.3
g. Interior finishes, such as walls, flooring, ceilings, doors (*N*=292)	170	58.2	11	3.8	97	33.2	11	3.8	3	1.0
h. Structural components, such as exterior facades, foundations, windows (*N*=288)	34	11.8	117	40.6	90	31.3	36	12.5	11	3.8
i. Parking lots and roadways (*N*=290)	26	9.0	142	49.0	72	24.8	33	11.4	17	5.9
j. Grounds, playgrounds, and athletic fields (*N*=291)	145	49.8	21	7.2	107	36.8	11	3.8	7	2.4

25. In your opinion, how effective were the overall staffing arrangements you described in Question 24 for accomplishing preventive maintenance in 1998-99? *(Mark one.)* (*N*=290)

Number	Percent	
89	30.7%	1. Very effective
170	58.6	2. Somewhat effective
14	4.8	3. Neither effective nor ineffective
9	3.1	4. Somewhat ineffective
1	1.7	5. Very ineffective
3	1.0	6. Uncertain or don't know

BEST COPY AVAILABLE

26. Do you share preventive maintenance services with other jurisdictions? *(Mark all that apply.)* (*N*=281)

Number	Percent	
249	88.6%	a. We do not share preventive maintenance services.
22	7.8	b. We share preventive maintenance services with other schools, cities, or counties in our region.
9	3.2	c. We share preventive maintenance services specifically for buildings or grounds we jointly own with another jurisdiction.
10	3.6	d. Other *(Please specify.)* ____________________

27. For the 1998-99 school year, please estimate how many person-hours were spent in your district on facility maintenance and operations. *(Please count hours, including overtime, worked by full-time, part-time, and seasonal employees on all maintenance of buildings, grounds, athletic facilities, and parking lots, including planning and administering this maintenance. If you have to convert numbers of employees into person-hours, one full-time equivalent worker equals 2,088 person-hours for the year, without accounting for overtime. If possible, break down the total number of hours by the types below.)*

	In-House Personnel Hours		Contracted Labor Hours	
	Mean	Median	Mean	Median
a. TOTAL Person-Hours	24,569.66	7,308.00 (*N*=245)	1,594.68	550.00 (*N*=210)
Types of Hours				
b. Preventive maintenance	3,409.78	1,078.00 (*N*=214)	303.35	100.00 (*N*=190)
c. Other planned maintenance and major repairs, including scheduled custodial work and work to reduce deferred maintenance	15,036.99	3,000.00 (*N*=214)	756.68	80.00 (*N*=190)
d. Unscheduled repairs and maintenance, including both emergency and less urgent projects	2,171.00	500.00 (*N*=214)	458.53	100.00 (*N*=190)
e. Other	876.92	0.00 (*N*=214)	10.55	0.00 (*N*=190)

FINAL COMMENTS

28. Do you have any final comments about preventive maintenance for facilities in your school districts?

____

____

Thank you for responding to this survey!
Please return it in the enclosed, postage-paid envelope by *November 30, 1999* to:

Office of the Legislative Auditor
Centennial Office Building – 1st Floor South
St. Paul, MN 55155
(Phone: 651/296-4708)

Or fax to: 651/296-4712

Survey of Cities

As part of the best practices review on preventive maintenance for local government buildings, the Office of the Legislative Auditor surveyed the 96 Minnesota cities with a population of 8,000 or more and a stratified random sample of 200 smaller cities. The aggregate results of cities' responses to the survey are available here.

The October 1999 survey went to city managers, administrators, or clerk-treasurers, who were asked to transfer the survey to the person most acquainted with preventive maintenance in their community. We received responses from 246 of the 296 cities surveyed for a response rate of 83.1 percent.

The survey asked cities about their preventive maintenance practices as well as obstacles limiting their ability to perform preventive maintenance. We also asked them about the management structure, staffing arrangements, and funding of their preventive maintenance for buildings.

Results of surveys sent to counties and school districts are also available on our website. Because city and county surveys contained similar questions, aggregate results combining both city and county responses are also available; for these aggregate results, contact project manager Jody Hauer at 651/296-8501 or jody.hauer@state.mn.us. For additional information on survey methodology, see Appendix A in the report.

Minnesota Office of the Legislative Auditor

Managing Preventive Maintenance for Local Government Buildings: A Best Practices Review

City Questionnaire

RESPONSE RATE:
We received responses from 163 of a sample of 200 cities with populations less than 8,000, and from 83 of the 96 Minnesota cities with a population of 8,000 or more, for an overall response rate of 83.1 percent.

Name: ______________________

Title: ______________________

Telephone Number: ______________________

Thank you for answering this questionnaire on preventive maintenance for local government buildings. Questions apply to preventive maintenance of city-owned buildings only—not including leased space, roads, or sewer or water systems. We recognize that responsibilities for preventive maintenance of buildings vary among cities. Please answer these questions only about the buildings for which you oversee maintenance. If your city has buildings managed by other people, you do not need to collect information from them.

Defining Preventive Maintenance—For purposes of this study, preventive maintenance means the repair and maintenance needed to extend the useful life of a building's components, including its roofing, plumbing, heating, ventilation, air conditioning, electrical systems, and exterior and interior construction and finishing. Preventive maintenance activities are those intended to prevent breakdowns, and they include periodic inspections, programmed minor and major maintenance, and minor repairs. They may also include predictive testing to determine building components' useful life.

In this definition, preventive maintenance includes regularly scheduled painting, resurfacing, lubricating, replacing parts, inspecting, testing, and renewing facility components. It does not include daily custodial work such as sweeping, mopping, emptying wastebaskets, cleaning restrooms, and moving furniture.

If you do not actively perform preventive maintenance for at least some building components, please answer questions 1 through 4 only.

1. **For approximately what percentage of your city-owned buildings does a centralized city facility manager oversee management of building maintenance and repairs?** *(Do not include the city's use of leased space in your estimate. Mark one box.)* (N=243)

Number	Percent	
64	26.3%	1. 100%—all buildings
30	12.3	2. 75 to 99%
19	7.8	3. 50 to 74%
6	2.5	4. 25 to 49%
11	4.5	5. 1 to 24%
79	32.5	6. None—each city department is responsible for the maintenance and repair of buildings it uses
34	14.0	7. Other *(Please describe.)* ______________________

BEST COPY AVAILABLE

2. If you perform at least some preventive maintenance for buildings you oversee, which of the following practices do you use? *(Mark one response for each practice.)*

Number	Percent (*N*=233)	
69	29.6%	1. We do not perform preventive maintenance *(Go to Question 3.)*

Practice	For Most or All Building Components		For Some Building Components		For No Building Components	
	Number	Percent	Number	Percent	Number	Percent
a. Maintain a current inventory of the condition and use of buildings and their components (*N*=150)	51	34.0%	61	40.7%	38	25.3%
b. Prepare checklists or procedures describing preventive maintenance tasks for employees to perform (*N*=149)	29	19.5	74	49.7	46	30.9
c. Schedule and perform regular inspections, maintenance, and minor repairs of building components according to manufacturers' specifications (*N*=152)	66	43.4	68	44.7	18	11.8
d. Maintain comprehensive records of preventive maintenance activities and their costs (*N*=148)	29	19.6	74	50.0	45	30.4
e. Review preventive maintenance records to identify system problems before a major failure occurs (*N*=149)	36	24.2	70	47.0	43	28.9
f. Maintain a proper level of materials and spare parts for each building to support timely maintenance and minor repairs (*N*=150)	34	22.7	89	59.3	27	18.0
g. Inspect building systems and equipment prior to warranty expiration (*N*=149)	66	44.3	52	34.9	31	20.8
h. Develop procedures manuals with guidelines for planning, controlling, and budgeting preventive maintenance (*N*=146)	8	5.5	47	32.2	91	62.3
i. Perform preventive maintenance activities according to formal, written plans (*N*=147)	18	12.2	49	33.3	80	54.4
j. Report to policy makers on building conditions, needs, and costs and benefits of maintenance over other options (*N*=152)	69	45.4	71	46.7	12	7.9

2.(k) What practices related to preventive maintenance for buildings do you find particularly effective or innovative?

3. We would like to know about obstacles that limited your ability to do preventive maintenance. Please indicate how serious the items below have been for your city. *(Mark one answer for each statement.)*

Number	Percent	(N=232)
79	34.1%	1. We have not encountered significant obstacles to preventive maintenance *(Go to Question 4.)*

Obstacle	Very Serious		Somewhat Serious		Not Very Serious, If At All	
	Number	Percent	Number	Percent	Number	Percent
a. Numerous emergency or unscheduled major repairs that preclude conducting preventive maintenance (*N*=133)	7	5.3%	40	30.1%	86	64.7%
b. Insufficient staff available for the necessary work (*N*=146)	41	28.1	70	47.9	35	24.0
c. Labor shortages in the region (*N*=138)	11	8.0	39	28.3	88	63.8
d. Insufficient training or expertise on implementing preventive maintenance (*N*=140)	16	11.4	50	35.7	74	52.9
e. Competition with other city expenditures for limited dollars (*N*=144)	73	50.7	47	32.6	24	16.7
f. Funding new construction without considering resulting increased maintenance needs (*N*=139)	26	18.7	42	30.2	71	51.1
g. City decisionmakers have not made preventive maintenance a high priority (*N*=141)	22	15.6	59	41.8	60	42.6
h. Levy limits that prevent cities from increasing their tax levies above a prescribed threshold (*N*=139)	45	32.4	40	28.8	54	38.8
i. Inexperience with presenting building maintenance information to policy makers (*N*=134)	9	6.7	39	29.1	86	64.2
j. Financing restrictions that dissuade spending on preventive maintenance *(Please specify.)* (*N*=121) ________________	22	18.2	33	27.3	66	54.5
k. Federal, state, or local requirements related to maintaining buildings or planning their maintenance *(Please specify.)* (*N*=116) ________________	4	3.4	23	19.8	89	76.7
l. Other obstacles *(Please specify.)* (*N*=50) ________________	7	14.0	8	16.0	35	70.0

4. **We would like to know about practices for financing and managing maintenance projects that were deferred, that is, maintenance that was not performed when it should have been. If you have deferred some maintenance projects, what strategies have you found effective for reducing the backlog of deferred maintenance?**

If you do not actively perform preventive maintenance for your buildings, please stop here and return this questionnaire in the postage-paid envelope or by faxing it to 651/296-4712. Thank you for responding.

5. **How consistently, if at all, does your city use the following budgeting and financing practices for preventive maintenance?** *(Mark one answer for each practice.)*

Practice	Consistently		Sometimes		Rarely, If Ever	
	Number	Percent	Number	Percent	Number	Percent
a. Each year, we budget a percentage of the replacement value of our buildings to provide adequate preventive maintenance. (*N*=141)	27	19.1%	31	22.0%	83	58.9%
b. We issue bonds for major preventive maintenance projects, instead of, or in addition to, levying taxes. (*N*=138)	6	4.3	24	17.4	108	78.3
c. We levy taxes specifically to acquire, maintain, and repair buildings. (*N*=140)	50	35.7	37	26.4	53	37.9
d. Our priorities for preventive maintenance projects do not compete with other city capital projects for funding. (*N*=137)	30	21.9	53	38.7	54	39.4
e. We have a capital improvement plan that includes financing for preventive maintenance. (*N*=141)	42	29.8	40	28.4	59	41.8
f. We plan for future expenditures with a master plan that estimates replacement or maintenance of building components. (*N*=138)	34	24.6	48	34.8	56	40.6
g. We set aside money for maintenance and repair based on the annual depreciation of building systems and equipment. (*N*=136)	19	14.0	39	28.7	78	57.4
h. We rely on reserved funds or accounts to finance preventive maintenance. *(Please describe the funds.)* (*N*=133) ____	30	22.6	56	42.1	47	35.3
i. Other *(Please describe.)* (*N*=17)____	6	35.3	3	17.6	8	47.1

5.(j) What practices for budgeting or financing preventive maintenance do you find particularly effective?

6. In the buildings for which you are responsible, which of the following staffing arrangements are used for preventive maintenance? *(Mark one.)* (*N*=149)

Number	Percent	
35	23.5%	1. We rely on in-house personnel to perform most or all preventive maintenance.
16	10.7	2. We contract with private services to perform most or all preventive maintenance.
96	64.4	3. We rely on in-house staff to perform some preventive maintenance and contract with private services for some preventive maintenance.
2	1.3	4. Other *(Please specify.)*

6.(a) Do you participate in shared maintenance services? *(Mark all that apply.)* (*N*=147)

Number	Percent	
4	2.7%	a. We share preventive maintenance services with other cities, counties, or schools in our region.
48	32.7	b. We share preventive maintenance services with other departments in the city.
8	5.4	c. We share preventive maintenance services for buildings we jointly own with another jurisdiction.
94	63.9	d. We do not have shared maintenance services.

6.(b) What staffing or cooperative arrangements for preventive maintenance of buildings do you find particularly useful or effective?

7. Do you have a written, long-range plan for building maintenance and repairs that extends out at least three to five years?

All Respondents Number	All Respondents Percent	(*N*=152)
114	75.0%	1. No *(Go to Question 8.)*
38	25.0	2. Yes

7.(a) If yes, please indicate whether your long-range plan contains the following. *(Mark all that apply.)*

All Respondents Number	All Respondents Percent	Respondents With a Written, Long-Range Plan Number	Respondents With a Written, Long-Range Plan Percent	(*N*=39)
15	9.9	15	38.5%	a. An inventory of buildings and their components, including their condition and expected remaining useful life
30	19.7	30	76.9	b. An estimate of costs to maintain or replace the components
8	5.3	8	20.5	c. A list of deferred maintenance by level of severity and the amounts needed to reduce the existing backlog
7	4.6	7	17.9	d. Other *(Please specify.)*

BEST COPY AVAILABLE

7.(b) In your opinion, how effective is your long-range planning compared to other jurisdictions with whom you may be familiar? *(Circle one.)* (*N*=71)

	Very Effective	Somewhat Effective	Neither Effective Nor Ineffective	Somewhat Ineffective	Very Ineffective
Number:	12	30	21	8	0
Percent:	16.9%	42.3%	29.6%	11.3%	0.0%

8. What practices, if any, do you use to evaluate the efficiency and effectiveness of your preventive maintenance? *(Mark all that apply.)* (*N*=119)

Number	Percent	
18	15.1%	a. Set goals for preventive maintenance and measure progress toward meeting them
61	51.3	b. Review records of preventive maintenance activities and system repairs to identify potential problems
51	42.9	c. Analyze costs and benefits of preventive maintenance to quantify savings
56	47.1	d. Survey building occupants to assess satisfaction levels about building environments
11	9.2	e. Follow a quality assurance program that includes evaluating work based on predetermined maintenance work standards and planning for corrective actions when needed
46	38.7	f. Compare trends in frequency of malfunctioning components and equipment
6	5.0	g. Other *(Please specify.)* ______

9. Finally, we also are interested in knowing about successful practices used to manage indoor air quality. If you follow specific practices for identifying and controlling indoor air quality problems, which do you find particularly effective?

Thank you for your responses.
Please return this questionnaire in the
enclosed envelope by *Monday, November 8, 1999* to:

Office of the Legislative Auditor
Program Evaluation Division
Centennial Building – 1st Floor South
St. Paul, MN 55155
(Phone: 651/296-4708) or fax to: 651/296-4712

Survey of Counties

As part of the best practices review on preventive maintenance for local government buildings, the Office of the Legislative Auditor surveyed the 87 counties in Minnesota. The aggregate results of counties' responses to the survey are available here.

The October 1999 survey went to facility managers, county engineers, or county administrators, who were asked to complete the survey or transfer it to the person most acquainted with preventive maintenance. We received responses from 73 of the 87 counties for a response rate of 83.9 percent.

The survey asked counties about their preventive maintenance practices as well as obstacles limiting their ability to perform preventive maintenance. We also asked them about the management structure, staffing arrangements, and funding of their preventive maintenance for buildings.

Results of surveys sent to cities and school districts are also available on our website. Because city and county surveys contained similar questions, aggregate results combining both city and county responses are also available; for these aggregate results, contact project manager Jody Hauer at 651/296-8501 or jody.hauer@state.mn.us. For additional information on survey methodology, see Appendix A in the report.

Minnesota Office of the Legislative Auditor

Managing Preventive Maintenance for Local Government Buildings: A Best Practices Review

County Questionnaire

Name: ______________________

Title: ______________________

Telephone Number: ______________________

RESPONSE RATE:

We received responses from 73 of the 87 Minnesota counties, for a response rate of 83.9 percent.

Thank you for answering this questionnaire on preventive maintenance for local government buildings. Questions apply to preventive maintenance of county-owned buildings only—not including leased space or road systems. We recognize that responsibilities for preventive maintenance of buildings vary among counties. Please answer these questions only about the buildings for which you oversee maintenance. If your county has buildings managed by other people, you do not need to collect information from them.

Defining Preventive Maintenance—For purposes of this study, preventive maintenance means the repair and maintenance needed to extend the useful life of a building's components, including its roofing, plumbing, heating, ventilation, air conditioning, electrical systems, and exterior and interior construction and finishing. Preventive maintenance activities are those intended to prevent breakdowns, and they include periodic inspections, programmed minor and major maintenance, and minor repairs. They may also include predictive testing to determine building components' useful life.

In this definition, preventive maintenance includes regularly scheduled painting, resurfacing, lubricating, replacing parts, inspecting, testing, and renewing facility components. It does not include daily custodial work such as sweeping, mopping, emptying wastebaskets, cleaning restrooms, and moving furniture.

If you do not actively perform preventive maintenance for at least some building components, please answer questions 1 through 4 only.

1. **For approximately what percentage of your county-owned buildings does a centralized county facility manager oversee management of building maintenance and repairs?** *(Do not include the county's use of leased space in your estimate. Mark one box.)* (N=73)

Number	Percent	
9	12.3%	1. 100%—all buildings
13	17.8	2. 75 to 99%
15	20.5	3. 50 to 74%
6	8.2	4. 25 to 49%
3	4.1	5. 1 to 24%
24	32.9	6. None—each county department is responsible for the maintenance and repair of buildings it uses
3	4.1	7. Other *(Please describe.)* ______________________

2. If you perform at least some preventive maintenance for buildings you oversee, which of the following practices do you use? *(Mark one response for each practice.)*

Number	Percent (*N*=73)	
11	15.1%	1. We do not perform preventive maintenance *(Go to Question 3.)*

Practice	For Most or All Building Components		For Some Building Components		For No Building Components	
	Number	Percent	Number	Percent	Number	Percent
a. Maintain a current inventory of the condition and use of buildings and their components (*N*=59)	17	28.8%	29	49.2%	13	22.0%
b. Prepare checklists or procedures describing preventive maintenance tasks for employees to perform (*N*=60)	22	36.7	20	33.3	18	30.0
c. Schedule and perform regular inspections, maintenance, and minor repairs of building components according to manufacturers' specifications (*N*=60)	28	46.7	25	41.7	7	11.7
d. Maintain comprehensive records of preventive maintenance activities and their costs (*N*=59)	18	30.5	24	40.7	17	28.8
e. Review preventive maintenance records to identify system problems before a major failure occurs (*N*=59)	15	25.4	24	40.7	20	33.9
f. Maintain a proper level of materials and spare parts for each building to support timely maintenance and minor repairs (*N*=60)	17	28.3	30	50.0	13	21.7
g. Inspect building systems and equipment prior to warranty expiration (*N*=60)	31	51.7	15	25.0	14	23.3
h. Develop procedures manuals with guidelines for planning, controlling, and budgeting preventive maintenance (*N*=58)	7	12.1	14	24.1	37	63.8
i. Perform preventive maintenance activities according to formal, written plans (*N*=59)	9	15.3	22	37.3	28	47.5
j. Report to policy makers on building conditions, needs, and costs and benefits of maintenance over other options (*N*=60)	39	65.0	18	30.0	3	5.0

2.(k) What practices related to preventive maintenance for buildings do you find particularly effective or innovative?

BEST COPY AVAILABLE

3. **We would like to know about obstacles that limited your ability to do preventive maintenance. Please indicate how serious the items below have been for your county.** *(Mark one answer for each statement.)*

Number	Percent (*N*=73)	
21	28.8%	I. We have not encountered significant obstacles to preventive maintenance *(Go to Question 4.)*

Obstacle	Very Serious		Somewhat Serious		Not Very Serious, If At All	
	Number	Percent	Number	Percent	Number	Percent
a. Numerous emergency or unscheduled major repairs that preclude conducting preventive maintenance (*N*=50)	3	6.0%	16	32.0%	31	62.0%
b. Insufficient staff available for the necessary work (*N*=51)	13	25.5	25	49.0	13	25.5
c. Labor shortages in the region (*N*=51)	3	5.9	13	25.5	35	68.6
d. Insufficient training or expertise on implementing preventive maintenance (*N*=51)	1	2.0	24	47.1	26	51.0
e. Competition with other county expenditures for limited dollars (*N*=51)	27	52.9	16	31.4	8	15.7
f. Funding new construction without considering resulting increased maintenance needs (*N*=51)	10	19.6	20	39.2	21	41.2
g. County decisionmakers have not made preventive maintenance a high priority (*N*=51)	12	23.5	20	39.2	19	37.3
h. Levy limits that prevent counties from increasing their tax levies above a prescribed threshold (*N*=50)	24	48.0	16	32.0	10	20.0
i. Inexperience with presenting building maintenance information to policy makers (*N*=51)	3	5.9	13	25.5	35	68.6
j. Financing restrictions that dissuade spending on preventive maintenance *(Please specify.)* (*N*=43) ________________	4	9.3	15	34.9	24	55.8
k. Federal, state, or local requirements related to maintaining buildings or planning their maintenance *(Please specify.)* (*N*=43)________________________________	0	0.0	5	11.6	38	88.4
l. Other obstacles *(Please specify.)* (*N*=18)________________	1	5.6	5	27.8	12	66.7

4. We would like to know about practices for financing and managing maintenance projects that were deferred, that is, maintenance that was not performed when it should have been. If you have deferred some maintenance projects, what strategies have you found effective for reducing the backlog of deferred maintenance?

If you do not actively perform preventive maintenance for your buildings, please stop here and return this questionnaire in the postage-paid envelope or by faxing it to 651/296-4712. Thank you for responding.

5. How consistently, if at all, does your county use the following budgeting and financing practices for preventive maintenance? *(Mark one answer for each practice.)*

Practice	Consistently		Sometimes		Rarely, If Ever	
	Number	Percent	Number	Percent	Number	Percent
a. Each year, we budget a percentage of the replacement value of our buildings to provide adequate preventive maintenance. (*N*=52)	6	11.5%	13	25.0%	33	63.5%
b. We issue bonds for major preventive maintenance projects, instead of, or in addition to, levying taxes. (*N*=53)	3	5.7	12	22.6	38	71.7
c. We levy taxes for a "county building fund" used to acquire, maintain, and repair buildings. (*N*=51)	24	47.1	13	25.5	14	27.5
d. Our priorities for preventive maintenance projects do not compete with other county capital projects for funding. (*N*=52)	18	34.6	24	46.2	10	19.2
e. We have a capital improvement plan that includes financing for preventive maintenance. (*N*=50)	10	20.0	17	34.0	23	46.0
f. We plan for future expenditures with a master plan that estimates replacement or maintenance of building components. (*N*=51)	7	13.7	23	45.1	21	41.2
g. We set aside money for maintenance and repair based on the annual depreciation of building systems and equipment. (*N*=52)	5	9.6	13	25.0	34	65.4
h. We rely on reserved funds or accounts to finance preventive maintenance. *(Please describe the funds.)* (*N*=46)	5	10.9	21	45.7	20	43.5
i. Other *(Please describe.)* (*N*=3)	3	100.0	0	0.0	0	0.0

5.(j) What practices for budgeting or financing preventive maintenance do you find particularly effective?

6. In the buildings for which you are responsible, which of the following staffing arrangements are used for preventive maintenance? *(Mark one.)* (*N*=55)

Number	Percent		
15	27.3%	1.	We rely on in-house personnel to perform most or all preventive maintenance.
0	0.0	2.	We contract with private services to perform most or all preventive maintenance.
40	72.7	3.	We rely on in-house staff to perform some preventive maintenance and contract with private services for some preventive maintenance.
0	0.0	4.	Other *(Please specify.)* ________

6.(a) Do you participate in shared maintenance services? *(Mark all that apply.)* (*N*=54)

Number	Percent		
0	0.0%	a.	We share preventive maintenance services with other counties, cities, or schools in our region.
13	24.1	b.	We share preventive maintenance services with other departments in the county.
6	11.1	c.	We share preventive maintenance services for buildings we jointly own with another jurisdiction.
38	70.4	d.	We do not have shared maintenance services.

6.(b) What staffing or cooperative arrangements for preventive maintenance of buildings do you find particularly useful or effective?

7. Do you have a written, long-range plan for building maintenance and repairs that extends out at least three to five years?

All Respondents Number	All Respondents Percent	(*N*=52)	
38	73.1%	1.	No *(Go to Question 8.)*
14	26.9	2.	Yes

7.(a) If yes, please indicate whether your long-range plan contains the following. *(Mark all that apply.)*

All Respondents Number	All Respondents Percent	Respondents With a Written, Long-Range Plan Number	Respondents With a Written, Long-Range Plan Percent	(*N*=14)	
8	15.4	8	57.1%	a.	An inventory of buildings and their components, including their condition and expected remaining useful life
9	17.3	9	64.3	b.	An estimate of costs to maintain or replace the components
6	11.5	6	42.9	c.	A list of deferred maintenance by level of severity and the amounts needed to reduce the existing backlog
3	5.8	3	21.4	d.	Other *(Please specify.)* ________

7.(b) In your opinion, how effective is your long-range planning compared to other jurisdictions with whom you may be familiar? *(Circle one.)* (*N*=24)

	Very Effective	Somewhat Effective	Neither Effective Nor Ineffective	Somewhat Ineffective	Very Ineffective
Number:	5	9	7	2	1
Percent:	20.8%	37.5%	29.2%	8.3%	4.2%

8. What practices, if any, do you use to evaluate the efficiency and effectiveness of your preventive maintenance? *(Mark all that apply.)* (*N*=48)

Number	Percent		
19	39.6%	a.	Set goals for preventive maintenance and measure progress toward meeting them
23	47.9	b.	Review records of preventive maintenance activities and system repairs to identify potential problems
24	50.0	c.	Analyze costs and benefits of preventive maintenance to quantify savings
34	70.8	d.	Survey building occupants to assess satisfaction levels about building environments
10	20.8	e.	Follow a quality assurance program that includes evaluating work based on predetermined maintenance work standards and planning for corrective actions when needed
24	50.0	f.	Compare trends in frequency of malfunctioning components and equipment
1	2.1	g.	Other *(Please specify.)* ______________________

9. Finally, we also are interested in knowing about successful practices used to manage indoor air quality. If you follow specific practices for identifying and controlling indoor air quality problems, which do you find particularly effective?

Thank you for your responses.
Please return this questionnaire in the
enclosed envelope by *Monday, November 8, 1999* to:

Office of the Legislative Auditor
Program Evaluation Division
Centennial Building – 1st Floor South
St. Paul, MN 55155
(Phone: 651/296-4708) or fax to: 651/296-4712

Site Visit Questionnaire

In January 2000, we visited 13 local governments meeting performance standards identified during the study of preventive maintenance for local government buildings. To gather in-depth information on jurisdictions' preventive maintenance methods and practices, we prepared a list of questions to ask during each visit. The questions are listed below.

The jurisdictions selected for site visits represent different population sizes and regions of the state. They are:

Aitkin County
Anoka-Hennepin School District
Detroit Lakes School District
Foley School District
Fridley School District
Hennepin County
City of Melrose
Norman County West School District
City of North St. Paul
South St. Paul School District
Wabasha-Kellogg School District
Westbrook School District
Worthington School District

OFFICE OF THE LEGISLATIVE AUDITOR

Preventive Maintenance of Local Government Buildings: A Best Practices Review

SITE VISIT QUESTIONNAIRE

OLA Staff:		**Date:**
Local Jurisdiction:		
Local Officials' Names:	**Titles:**	**Phone Numbers:**
(1)		
(2)		
(3)		
(4)		

Best Practices:
(1)
(2)
(3)
(4)
(5)
(6)
(7)

1. Describe the practice. What is it? What tasks/activities are included in the practice? How does it work?
2. Why did you first begin the practice? What problems were you hoping to overcome or avoid?
3. Did the practice solve these problems? Why or why not?
4. Does the practice produce savings in time, money, labor, resources, or hassles? If so, did the savings appear immediately or over time? Can you quantify any of the savings?
5. Have you found other advantages from using the practice?
6. What does the practice cost in dollars? Time? Labor hours to complete? How is it funded?
7. Have you found any problems or disadvantages with the practice? Have you had to change it over time to improve it?
8. Thinking back to when you began the practice, did you have any problems with the initial startup? If so, how did you overcome them?
9. Do you think other facility managers could also use the practice? Could it work for school districts? Cities? Counties? Does a jurisdiction have to be of a certain size to successfully use the practice?
10. What tips or advice would you offer to another facility manager considering the same practice?
11. Do you have any additional thoughts or comments?
12. I'd like to use your name as a contact person and list your number in the final report for readers who may want additional information. Is this all right with you?
    - ☐ yes
    - ☐ no